

Geotechnical Report

Trunk Highway 7 / Louisiana Avenue Interchange

St. Louis Park, Minnesota

S.P. No. 2706-226

S.P. No. 163-101-038

SEH No. STLOU 116227

March 19, 2012



Building a Better World
for All of Us™

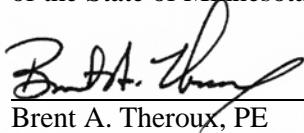
Engineers | Architects | Planners | Scientists

Trunk Highway 7 / Louisiana Avenue Interchange
Geotechnical Report
St. Louis Park, Minnesota

S.P. NO. 2706-226, S.P. NO. 163-101-038
SEH No. STLOU 116227

March 16, 2012

I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.


Brent A. Theroux, PE

Date: March 16, 2012 Lic. No.: 44276

Reviewed by: Wayne J. Wamboldt March 16, 2012
Date

Short Elliott Hendrickson Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110-5196
651.490.2000

Table of Contents

Letter of Transmittal

Certification Page

Title Page

Table of Contents

	Page
1.0 Introduction	1
2.0 Background Information.....	2
2.1 Scope of Services.....	2
3.0 Drilling and Laboratory Testing Program.....	2
3.1 Drilling	2
3.2 Laboratory Testing.....	3
4.0 General Site Conditions.....	3
4.1 Overview of previous work performed at the site	3
4.1.1 TH 7 Fill Embankment and Bridge (circa 1934).....	3
4.1.2 TH 7 & Louisiana Avenue Intersection (circa 1980).....	3
4.2 Existing Site Conditions	4
4.2.1 Site Conditions.....	4
4.2.2 Existing Pavement Conditions.....	4
4.3 Soil Conditions	6
4.3.1 General.....	6
4.3.2 Bridge	6
4.3.3 TH 7 Embankment	7
4.3.4 Louisiana Avenue and Side Streets	7
4.4 Rock Conditions	7
4.5 Groundwater.....	8
5.0 Geotechnical Evaluations.....	9
5.1 Bridge Foundations	9
5.2 Abutment Backfill.....	10
5.3 Retaining Walls	10
5.4 General Embankment.....	11
5.5 East Approach Embankment	11
5.5.1 Muck Excavation (Remove/Replace)	11
5.6 West Approach Embankment	12
5.7 Pile Supported Embankment	13
5.7.1 Pile Foundations and Pile Caps	13
5.7.2 Load Transfer Platform (LTP).....	14
5.8 West Embankment Ramps and Temporary Bypass.....	15
5.8.1 Surcharges	15
5.9 Pavement and Subgrade	16
5.10 Utilities.....	17
5.11 Ponds.....	18
6.0 Construction Monitoring and Instrumentation.....	18
6.1 Construction Monitoring.....	18

Table of Contents (Continued)

6.1.1	Load Transfer Platform	18
6.1.2	Embankment Surcharges.....	18
6.2	Instrumentation.....	18
6.2.1	Earth Pressure Cells	18
6.2.2	Piezometers.....	19
6.2.3	Geotextile Strain Gages	19
6.2.4	ShapeAccelArray™ System	19
6.2.5	Settlement Plates.....	20
6.2.6	Vibration Sensors (Geophones) and Noise Sensors	20
7.0	General Conditions and Considerations	20

List of Tables

Table 1 a	TH 7 Pavement – West of Louisiana Avenue.....	5
Table 1 b	TH 7 Pavement – East of Louisiana Avenue.....	5
Table 1 c	Louisiana Avenue Pavement	6
Table 1 d	Adjacent Streets Pavement	6
Table 2	Bedrock Conditions.	8
Table 3	Bridge Pile Foundation Summary	9
Table 4	Retaining Wall Foundation Summary.....	10
Table 5 a	Recommended Material Properties for LTP Geogrids.....	14
Table 5 b	Recommended Material Properties for LTP Base Geotextile1.	15
Table 6	Surcharge Summary.....	16
Table 7	Summary of Pavement Evaluation.....	16
Table 8	Utility Soil Conditions (approx. north to south along Louisiana Ave.)	17

List of Preliminary Appendices

Appendix A	Boring Location Map
Appendix B	Braun Soil Boring Report, 2011
Appendix C	SEH Phase II Investigation (Submitted under Separate Cover)
Appendix D	Braun Soil Boring Report, 2009
Appendix E	Braun Soil Borings, 2004
Appendix F	STS Soil Borings, 1989
Appendix G	Braun Soil Borings, 1980
Appendix H	Groundwater Elevation Table
Appendix I	Water Level Data from Summit Observation Well, W425
Appendix J	Literature Paper by Jim Collin

Geotechnical Report

Trunk Highway 7 / Louisiana Avenue Interchange

Prepared for City of St. Louis Park

1.0 Introduction

A new controlled-access freeway interchange is proposed at the intersection of Trunk Highway 7 (TH 7) and Louisiana Avenue in the city of St. Louis Park, Minnesota. Currently the intersection consists of an at-grade crossing with a traffic signal. The new interchange will consist of a double-span bridge with new 15-foot high approach embankments to carry TH 7 over Louisiana Avenue and three new roundabouts along Louisiana Avenue. Other project elements include a retaining wall along both approach embankments, new embankment fill in ramp areas, a subcut along Louisiana Avenue as it crosses beneath the new bridge, a temporary bypass to maintain traffic during construction, two new stormwater ponds, storm sewer, sanitary sewer, and water main utilities. The project extends along TH 7 from 1500 feet west to 1700 feet east of Louisiana Avenue, and along Louisiana Avenue from 900 feet north to 850 feet south of TH 7. It also includes portions of Walker Street, Lake Street, and the frontage roads located both north and south of TH 7.

Organic soils consisting of peat and organic silt and clay, as well as areas of creosote and other environmental contaminants, are known to exist across the site. While observations of “foreign odors” were noted by the driller on the soil boring logs, this report discusses only the geotechnical aspects of the proposed project features. Information pertaining to environmental analysis and impacts to the project can be found in the “Phase II Investigation Report for the Trunk Highway 7 and Louisiana Avenue Interchange” prepared by SEH and dated January, 2012.

The bridge abutments, central bridge pier, and retaining walls will be supported on driven H-pile foundations bearing on bedrock. Due to environmental contamination, the west approach embankment will also be supported on driven H-piles bearing on bedrock; embankment loads will be transferred to the piles via a Load Transfer Platform (LTP) that consists of geosynthetic reinforcement layers and select fill. Areas of embankment fill for the entrance/exit ramps located outside of the pile-supported LTP will be surcharged. Soil correction beneath the east approach embankment is proposed to consist of 15 to 30 feet of muck excavation and replacement. Construction is proposed to occur in multiple phases, which includes the creation of a temporary paved bypass in order to maintain traffic during the project.

This report presents the results of the project subsurface investigation (completed in 2011); summaries of selected previous subsurface investigations; and geotechnical evaluations for the bridge, retaining walls, approach and ramp embankments, pavement subgrades, buried utilities, and ponds. Geotechnical recommendations for final design of the TH 7 and Louisiana Avenue Interchange are provided herein.

2.0 Background Information

SEH was provided the following documents for reference:

- Braun Intertec, Boring Logs ST-64 and ST-65 (1980)
- Hennepin County Soil Atlas (1989)
- STS Consultants, Boring Logs B-1, B-2, B-4, and B-5 (1989)
- Braun Intertec, Boring Logs ST-1 to ST-5 (2004)
- Braun Intertec, Soil Boring Report (2009)
- Summit Environmental, Water Level Data in Drift Zone, Observation Well W425 (2009-11)
- SEH, Phase II Environmental Investigation Geoprobe Logs GP-1 to GP-33 (2011)

2.1 Scope of Services

This report was prepared in accordance with the April 4, 2011 proposal by SEH to the City of St. Louis Park.

The scope of work for preparing this report included drilling soil borings and performing laboratory testing; these services were provided by Braun Intertec, Inc. of Minneapolis, Minnesota. Details of the drilling and laboratory testing program are discussed in the “Field and Laboratory Investigation” section of this report.

Geotechnical evaluation included providing recommendations for pile capacity, muck excavation, surcharge design, roadway subgrade; as well as assessments of slope stability at retaining wall and embankment slope locations, settlement due to surcharges at ramp locations, and potential impacts from dewatering and staged muck excavation. The scope did not include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, ground water, or air on, below or adjacent to the site.

3.0 Drilling and Laboratory Testing Program

All borings and laboratory testing were completed by Braun Intertec, Inc. of Bloomington, Minnesota between May 9 and June 13, 2011. All soils were classified in accordance with the MnDOT triangular textural soil classification system. The final boring logs were prepared utilizing the MnDOT gINT[®] templates. The county coordinates and elevation for each boring are provided on the logs. The final boring logs, as completed by Braun, and considered for the bridge foundation analysis are enclosed with this memorandum, as well as a boring location diagram prepared by SEH.

3.1 Drilling

The subsurface investigation consisted of both soil borings and cone soundings (C-1 to C-12). Soil borings consisted of standard penetration test-type (SPT) borings (B-1 to B-14, E-1 to E-5, P-1, and R-1 to R-9) and flight auger-type (FA) borings (S-1 to S-21).

Borings E-1 to E-5 and R-1 to R-9 and soundings C-1 to C-12 were designated as foundation borings. Foundation borings were performed in general conformance with the document “MnDOT Specifications for Subsurface Investigation and Geotechnical Analysis and Design Recommendations”, which specifies drilling and testing procedures for borings used in foundation design of structures. These borings were conducted at locations for the bridge abutments, central bridge pier, retaining walls, and fill embankments over suspected organic soils. The CPT soundings were implemented as substitutes for SPT foundation borings originally located within the TH 7 traffic lanes or along the TH 7 shoulder where time and

traffic control restrictions were imposed on drilling operations by the MnDOT permitting office. Borings E-1 to E-5 were drilled through organic soils to a depth of 41 feet. Borings R-1 to R-9 were drilled to top of bedrock and then rock cored approximately 10 feet. Soundings C-1 to C-12 were advanced until cone refusal, generally at a depth shallower than the apparent top of bedrock.

Borings B-1 to B-14 and S-1 to S-21 were designated as roadway borings and performed for the purposes of subgrade evaluation and existing pavement section measurements. Roadway borings were drilled through existing pavement sections along TH 7 and Louisiana Avenue and along proposed new ramp embankment alignments. Borings B-1 to B-14 were drilled to a depth of 21 feet. Boring S-1 to S-15 were drilled through existing TH 7 pavement to a depth of 10 feet. Borings S-17 to S-21 were drilled through existing Louisiana Avenue pavement to a depth of 6 feet. Boring S-16 was not drilled due to environmental concerns at its proposed location and was deleted from the investigation program.

Boring P-1 was drilled in the approximate area for a proposed stormwater pond for the purpose of assessing soil stratigraphy and hydrologic qualities.

3.2 Laboratory Testing

Lab testing was performed on foundation borings in general conformance with MnDOT criteria, which requires moisture content tests for all recovered split-spoon samples and dry unit weight and unconfined compression tests for all recovered thin wall samples. In addition, Atterberg limits, gradations, organic content, consolidation, and undrained-unconsolidated triaxial tests were performed on selected samples from all borings.

4.0 General Site Conditions

4.1 Overview of previous work performed at the site

The following paragraphs provide an overview of earthwork performed as part of two previous major construction projects at the site.

4.1.1 TH 7 Fill Embankment and Bridge (circa 1934)

MnDOT historical records indicate a majority of the original Trunk Highway 7 was constructed in 1934. Construction involved several areas of both cuts and fills. In the vicinity of the current project, earthwork primarily entailed building a fill embankment for the highway over peat soils. The extent to which the peat was to be removed or displaced during construction was not noted. The maximum height of the embankment above surrounding finished grade was indicated to be approximately 20 feet, although the original plans note that the final embankment grade was subject to change pending final plan approval. In conjunction with the embankment construction, a bridge was also built to carry the highway over an existing railroad alignment (in the vicinity of borings E-5 and C-11). The plans show a complete excavation of the peat soils in the area for the bridge foundation, which consisted of timber piles. Other than noting the area of peat soils and an apparent “firm bottom,” no other soil or earthwork information pertaining to this area of the project was available.

4.1.2 TH 7 & Louisiana Avenue Intersection (circa 1980)

In 1982, the TH 7 embankment was cut down in order to implement an at-grade intersection with the newly extended Louisiana Avenue. The embankment height was decreased approximately 15 to 20 feet. The project included the removal of the TH 7 Bridge over the railroad, a 4-foot subcut along TH 7, and muck excavation and a 9-foot embankment surcharge along Louisiana Avenue. According to MnDOT records, the surcharge along

Louisiana Avenue extended from approximately 200 feet north to 300 feet south of TH 7. The material specifications for the surcharge and backfill material were not contained in the MnDOT records made available. MnDOT records also did not indicate whether the railroad was abandoned in conjunction with the bridge removal or at a later date. The railroad is no longer present at the site.

4.2 Existing Site Conditions

The following paragraphs provide a summary of the existing soil and rock conditions encountered during the subsurface investigation performed as part of the current project. Available subsurface data from previous investigations are also presented. Although odors were detected during drilling and testing that may be representative of possible contamination, any environmental impacts were not assessed. Any discussion of environmental considerations pertaining to potential contamination is beyond the scope of this report. Soil samples that exhibited a “foreign odor,” as observed by Braun Intertec, are noted on the boring logs.

4.2.1 Site Conditions

The project area is located at the existing intersection of TH 7 and Louisiana Avenue in St. Louis Park, Minnesota. TH 7 is a four-lane divided highway with double left-turn lanes at the traffic signal. Louisiana Avenue is a four-lane street with double left-turn lanes at the traffic signal and concrete curbs. Pavement along TH 7, Louisiana Avenue, and all side streets within the project area are bituminous-surfaced. Low-lying areas exist below roadway grades northeast and southeast of the intersection. A multi-story apartment building is situated northwest of the intersection, separated from TH 7 by a low-lying ditch with cattails. Southwest of the intersection is a parking lot with bituminous pavement. According to the City, the parking caps a methane venting system associated with the underlying methane gas-producing peat soils.

4.2.2 Existing Pavement Conditions

All existing roadways within the project area consist of bituminous pavements. The thickness of the bituminous sections varied for each roadway. See Tables 1a to 1d for summaries of the various pavement thicknesses. No apparent aggregate base section was observed in the soil borings along TH 7.

Table 1a
TH 7 Pavement – West of Louisiana Avenue

Boring	Traffic Direction	Pavement Thickness (in.)	P200 of Granular Base (%)
B-1	Eastbound	12.5	
S-1	Eastbound	12.5	15
B-2	Westbound	13	12
S-2	Westbound	13.5	
B-3	Eastbound	13.5	
S-3	Eastbound	13	
B-5	Westbound	12	16
S-4	Westbound	12.5	
E-1	Westbound	11.5	
S-5	Westbound	13.5	
E-2	Eastbound	11	
S-6	Eastbound	13	
E-3	Westbound	11.5	
S-7	Eastbound	11	
Average		12.4	14.3

Table 1b
TH 7 Pavement – East of Louisiana Avenue

Boring	Traffic Direction	Pavement Thickness (in.)	P200 of Granular Base (%)
S-8	Westbound	12.5	
E-5	Eastbound	11	
S-9	Westbound	14.5	
S-10	Eastbound	14	
B-8	Eastbound	14	14
S-11	Westbound	13	
B-9	Westbound	15.5	14
S-12	Eastbound	14	13
B-10	Eastbound	14	
S-13	Westbound	13	
B-12	Westbound	19	5
S-14	Eastbound	14	16
B-13	Eastbound	18	21
S-15	Westbound	10	11
B-14	Westbound	12	
Average		13.9	13.4

Table 1c
Louisiana Avenue Pavement

Boring	Traffic Direction	Pavement Thickness (in.)	P200 of Granular Base (%)
S-17	Northbound	17	
S-18	Northbound	12	8
R-6	Median	4	
R-5	Northbound	10.5	
S-19	Northbound	12	
S-20	Northbound	8.5	8
S-21	Centerline	22	16
Average for Louisiana Avenue		13.7	10.7

Table 1d
Adjacent Streets Pavement

Boring	Traffic Direction	Pavement Thickness (in.)	P200 of Granular Base (%)
B-4	North Frontage Road.	8.5	22
B-6	South Frontage Road.	8	
B-11	Lake Street West (median)	4	14

4.3 Soil Conditions

4.3.1 General

Fill consisting of generally sandy material was encountered to varying depths across the project site. Underlying the fill in many areas were organic soils ranging from peat to organic clay. Natural outwash sand with gravel and some alluvial sediment were encountered below the fill and organic soils. The outwash sands were generally medium dense to dense, extended to top of bedrock, and contained lenses of fine-grained glacial till.

4.3.2 Bridge

At the bridge location, fill thicknesses varied from approximately 17 feet at the north side of the intersection (R-6) to approximately 27 feet at the southwest portion of the intersection (R-4). The fill material was generally a mix of sand, loamy sand, sandy loam, clay, clay loam, sandy clay loam, and gravel. Fill material ranged in density from loose to medium dense.

Organic soils were encountered below the fill material. The organic soils consisted of peat; organic silt and silt loam; and organic clay and clay loam. The depth to the bottom of the organic soils ranged from approximately 20 feet (C-5) to 34 feet (R-4), with thicknesses ranging from less than one foot (R-5) to 10 feet (C-6, R-6). It's likely that the variation in depth and thickness is primarily due to displacement of the organics during the original highway embankment construction in 1934.

Natural soils encountered below the fill and organics consisted mainly of medium dense to dense outwash sand with varying degrees of gravel and silt and clay. In R-4 and R-5 the outwash sand deposits contained layers mostly gravel. A few lenses of sandy loam till were

also encountered at depth. Possible floating cobbles or boulders within the outwash were noted by the driller at depths of approximately 45 feet in R-1 and 65 feet in R-4.

4.3.3 TH 7 Embankment

Within the footprint of the new embankment west of Louisiana Avenue, fill depths ranged from approximately 6 feet (C-3) to approximately 27 feet at the southwest portion of the intersection (R-4). East of Louisiana Avenue, fill depths varied from 12 feet at the east end of the embankment (R-9, C-12) to 30 feet at the intersection (C-7). The fill material was generally a mix of sand, loamy sand, sandy loam, clay, clay loam, sandy clay loam, and gravel. Fill material ranged in density from loose to medium dense.

Organic soils were encountered below the fill material. The organic soils consisted of peat; organic silt and silt loam; and organic clay and clay loam. West of Louisiana Avenue the depth to the bottom of the organic soils ranged from approximately 15 feet (E-1) to 34 feet (R-4), with thicknesses ranging from 3 feet (C-4) to 20 feet (C-1, C-2). East of Louisiana Avenue the depth to the bottom of the organic soils ranged from approximately 17 feet (R-9, C-12) to 39 feet (C-9), with thicknesses ranging from 5 feet (R-9, C-12) to 14 feet (C-9). It's likely the variation in organic depths and thicknesses is primarily due to displacement of the organic soils during the original highway embankment construction in 1934.

It should be noted that no discernible layers of organic soils were identified in boring E-5 or sounding C-11, which were located in the approximate location of the old bridge carrying TH 7 over a railroad line. This finding would seem to corroborate the complete muck excavation of organic soils from under the bridge as shown in the 1934 MnDOT historical record.

Natural soils encountered below the fill and organics consisted mainly of medium dense to dense outwash sand with varying degrees of gravel and silt and clay. In E-1, E-4, C-6, R-7, and E-5 the outwash sand deposits exhibited strata layers consisting of mostly gravel. A few lenses of sandy loam till were also encountered at depth. Possible cobbles or boulders within the outwash were noted by the driller in other borings between approximate depths of 35 and 75 feet.

4.3.4 Louisiana Avenue and Side Streets

Fill material beneath Louisiana Avenue consisted of sand and loamy sand (S-17 to S-21).

Approximately 5 ½ feet of loose sandy loam fill was encountered along Lake Street West at the entrance to the SW parking lot. Below the fill were a 2-foot layer of peat and a 2-foot layer of firm alluvial clay overlying medium dense outwash sand.

Four feet of dense loamy sand fill over medium dense outwash sand was encountered in B-11 at the Lake Street West entrance and exit along the north side of TH 7.

4.4 Rock Conditions

Bedrock consisted of dolomitic limestone of the Platteville Formation. The apparent top of bedrock was taken as the depth to which refusal of the hollow stem auger system was observed prior to commencing rock coring. The depth to bedrock was somewhat consistent, ranging from 70 to 76 feet, or elevation 820.3 to 822.0. The rock quality designation (RQD) for each 5-foot run of rock core collected is provided in Table 2. The average RQD for the first core run was 47, or poor. For the second core run the average RQD was 90, or good/excellent. A definition of the RQD measurement is provided in the 2011 Braun soil report (Appendix A).

Table 2
Bedrock Conditions.

Boring	Bedrock Depth (ft)	Bedrock Elevation	RQD, Run 1	RQD, Run 2
R-1	73	820.9	42	90
R-2	75	817.9	55	98
R-3	70	822.0	20	90
R-4	75	820.3	77	91
R-5	75	822.0	84	82
R-6	76	821.0	68	98
R-7	73	823.6	50	88
R-8	70	818.0	0	93
R-9	72	825.7	26	84
Average	73	821.3	47	90

4.5 Groundwater

Groundwater measurements were recorded in each boring A) during drilling operations while hollow stem auger was in the ground, B) when full depth was reached with hollow stem auger in the ground, and C) immediately after withdrawal of the hollow stem auger.

Groundwater was encountered in a majority of the borings. Groundwater was observed between elevations of 878 and 893 across the project site. The average elevation was 884.9 with a standard deviation of 2.8 feet.

The subsurface investigation performed as part of the project's Phase II evaluation included 33 geoprobe borings. The Phase II investigation measured groundwater elevations between elevations 873 and 891. A previous geotechnical investigation performed by Braun Intertec for SEH in 2009, which included 12 soil borings, found groundwater elevations 874 and 885.

Water level data from an observation well located just northeast of the project site was provided from Summit Environmental, an environmental consultant monitoring groundwater behavior for the City of St. Louis Park. The observation well, W425, is screened to collect water levels within the drift zone, or the collection of outwash sands and surface fills above bedrock. The well data consisted of local water table elevation measurements from January 2009 to April 2011. Over that period, the minimum recorded elevation was approximately 880.9 and the maximum was approximately elevation 882.5; the maximum elevation reading occurred in April 2011 at the limit of the plotted observation period and appeared to be trending upward.

The observation well data was compared to the groundwater measurements recorded from the 2009 soil borings, which were performed from March 25 to 29, 2009. The average groundwater elevation recorded from the 2009 soil borings was 881.1 with a standard deviation of 3.2 feet. From the observation well data, the groundwater elevation within the drift zone at the end of March, 2009 was approximately 881.7. From this comparison, there appears to be a reasonable corroboration between the observation well data and the soil boring groundwater measurements.

In general, based on the 2011 and 2009 soil borings and the 2011 geoprobe borings, groundwater observed within and above organic soil layers appears to be mainly perched and

thus more susceptible to daily and seasonal fluctuations. A table summarizing the approximate groundwater depths and elevations measured at boring locations is provided in the Appendix.

Groundwater measurements during drilling operations in sandy soils can be representative of current levels. However, long term water levels in organic and predominantly silty and/or clayey soils may not be indicative of the long term water table. Measurements should be performed with the aid of an open pipe piezometer in order to obtain a more accurate depiction of water levels over a period of time. In general, groundwater levels should be expected to fluctuate based on a variety of reasons, including season, temperature, runoff, and other factors.

5.0 Geotechnical Evaluations

The recommendations provided in this report are based on the proposed project layout, results of the subsurface investigation, discussions with MnDOT Foundations staff, our review of relevant information made available to us, and our understanding of the nature of the proposed project. If any project elements change, or soil and groundwater conditions are encountered that vary from those described in this report, it is necessary that we be notified so we may review our recommendations to determine if revisions are required.

5.1 Bridge Foundations

The new TH 7 Bridge will be a two-span structure. Substructures will be supported on steel HP 12x53 non-displacement piles driven to bear on bedrock. Analyses were performed for the purpose of evaluating the static pile capacity for the bridge foundations. A static capacity calculation using the Nordlund-Thurman method for cohesionless soils was performed using soil conditions from boring R-5, which depicted the least amount of organic soil. The calculation yielded an ultimate static capacity of only 117 tons at elevation 822. For reference, the average bedrock elevation is 821.1. The analyses indicate that the outwash sands located at depth across the site do not have sufficient skin friction and end-bearing capacity for support of the bridge foundations. Therefore it is recommended that the piles be driven to bedrock obtain capacity in end bearing.

Per the 2010 AASHTO LRFD Bridge Design Manual, steel piles supported on top of competent bedrock should be assumed to have a static end-bearing capacity governed by the yield strength of the steel. HP 12x53 piles composed of A572 steel will be used for support of the bridge. Table 10.2.1 from the MnDOT LRFD Bridge Design Manual stipulates HP 12x53 piles to be limited to a factored axial load (P_u) of 140 tons (this includes downdrag load, discussed below). When driven to bear on rock, a factored design load (ϕR_n) of 140 tons should be used. Pile lengths will be governed by the top of bedrock elevation (see Table 2). Table 3 provides a summary of the foundation recommendations for the abutments and central pier.

Table 3
Bridge Pile Foundation Summary

Substructure	West Abutment	Central Pier	East Abutment
Assumed Base Elevation	898.8	886.6	899.2
LRFD Axial Capacity, ϕR_n (tons)	140	140	140
Boring	R-4	R-5, R-6	R-7
Estimated Tip Elevation	820.3	821.5	824.6
Estimated Pile Length (ft)	79	65	75

Organic soils up to 10 feet thick may contribute up to an additional 20 tons of negative skin friction (i.e. downdrag) load on the piles. Below the organic soils, driven piles will penetrate through predominantly granular soils that are not anticipated to generate downdrag forces.

For a detailed evaluation and further discussion regarding the bridge foundation recommendations, please refer to Memorandum regarding Subsurface Conditions and Foundation Recommendations for Bridge No. 27301, dated July 28, 2011, included in the Appendix.

5.2 Abutment Backfill

Abutment backfill must be well-drained in order for the following recommendations to be valid. It is recommended that any material placed as backfill behind the abutments consist of granular borrow meeting the requirements of MnDOT 3149.2B1. Material meeting this specification is recommended to be consistent with the suitable on-site fill that will be re-used to construct the adjacent approach embankments. Compaction of materials is recommended to comply with the requirements of MnDOT 2451. Lifts should be limited to no more than 1 foot in loose thickness.

For abutment backfills so constructed, the lateral earth load may be computed using the following equivalent fluid density (efd) expressed in pounds per cubic foot (pcf). This is based on the assumption that the compacted granular backfill soils will have a moist unit weight of 125 pcf, an angle of internal friction (ϕ) of 30°, and there is not lateral loading due to water.

Active Earth Pressure: efd = 42 pcf
At Rest Earth Pressure: efd = 63 pcf

5.3 Retaining Walls

Two cast-in-place (CIP) concrete retaining walls will be constructed along the north side of the west approach embankment (NW wall) and the south side of the east approach embankment (SE wall). Both walls will be supported on steel HP 12x53 non-displacement piles. MnDOT standards for pile supported CIP concrete retaining walls require the piles to develop a working load capacity of 60 tons (see MnDOT Standard Plan Sheet No. 5-297.630, 2 of 4). The piles are recommended to be driven to bear on bedrock where the allowable factored load of 140 tons for the steel HP 12x53 piles provides sufficient capacity to develop the 60 ton working load. Table 4 provides a summary of retaining wall pile recommendations. Wall foundations will be buried a minimum of 4 feet per MnDOT guidelines.

Table 4
Retaining Wall Foundation Summary

Wall	NW Wall	SE Wall
Footings Elevations	892.2-899.1	893.4-899.4
Borings	R-2, R-6	R-5, R-8, R-9
Estimated Tip Elevation	819.5	821.9
Estimated Pile Lengths (ft)	73-80	72-78
Estimated Pile Capacity, Working Load (tons)	60	60

It is recommended that any material placed as backfill behind the retaining walls consist of granular borrow meeting the design criteria of MnDOT standard plan sheets for retaining walls (e.g. 5-297.630). Compaction of materials is recommended to comply with the requirements of MnDOT 2451. Lifts are recommended to be limited to no more than 1 foot in loose thickness.

For wall backfill so constructed, the lateral earth load may be computed using the following equivalent fluid densities (efd) expressed in pounds per cubic foot (pcf). These are based on MnDOT criteria that the compacted soils will have a moist unit weight of 125 pcf, an effective angle of internal friction (ϕ') of 35°, and be well-drained so there is minimal lateral loading due to water pressure. They are valid for level backfill with no surcharge load and no hydrostatic load.

Active Earth Pressure: efd = 34 pcf

At Rest Earth Pressure: efd = 54 pcf

5.4 General Embankment

Unless otherwise recommended below, embankment fill sections are recommended to be constructed in accordance with MnDOT 2105. Compaction is recommended to follow the Specified Density Method as outlined in MnDOT 2105. Outside of specific areas discussed herein, on-site non-organic granular and loamy soils are suitable for re-use as common borrow. However, due to environmental concerns, it is recommended to refer to the Phase II Investigation Report for further information regarding the disposition of on-site soils.

5.5 East Approach Embankment

5.5.1 Muck Excavation (Remove/Replace)

The east approach embankment will extend from the east bridge abutment at approximate Station 986+05 to Station 993+00. The SE retaining wall extends along the south side of the embankment from the east abutment to Station 990+80. Side slopes along the main alignment range from 2.3H:1V to flatter than 6H:1V; outer fill slopes along the ramp sections are as steep as 2H:1V. The maximum embankment height will be approximately 15 feet above existing grade at the east abutment.

Compressible organic soils consisting of peat and organic clay and silt were encountered beneath variable fill soils within the east embankment footprint. Settlements up to 22 to 27 inches due to consolidation of the organic soils are estimated to occur at the east abutment if no ground improvement measures are taken. Additional settlement due to secondary compression would also occur in the long term. Beyond settlement, consolidation and secondary compression would generate downdrag forces acting on the east abutment and SE retaining wall piles. Such settlements and the associated downdrag forces are not acceptable beneath bridge approach embankments.

The findings of the Phase II investigation indicate that some soils encountered in the area of the east embankment footprint qualify as unrestricted reuse material or may be eligible for re-use on the project site. The final disposition of the soil will be determined in the approved Response Action Plan (RAP).

It is therefore recommended to muck excavate the compressible organic soils from beneath the east approach embankment and northeast and southeast ramp fill areas and to replace with select fill. A muck excavation would eliminate the potential for unacceptable embankment settlements

and pile downdrag forces. Vertical and horizontal limits of the muck excavation should be in accordance with guidelines provided in the MnDOT Geotechnical and Pavement Manual.

Dewatering will likely be required to accomplish removal of all organic soils. Drawdown of groundwater levels by construction dewatering may impact adjacent structures and ground areas. Possible measures for monitoring adjacent structures include, but are not limited to, crack gauges, photo documentation, structure surveys, and water level readings.

Excavation stability should follow OSHA standards and should be the responsibility of the contractor. If a temporary shoring system is required, the contractor should submit for review a muck excavation plan providing for temporary shoring. The contractor should also be required to submit a dewatering plan for construction that includes both a pre-condition survey and provisions for monitoring and repairing adjacent structures and ground areas. Both the muck excavation plan and dewatering should be prepared and bear the stamp of a professional engineer licensed in the state of Minnesota and experienced with similar projects.

Replacement fill placed below the water table and up to a minimum of 3 feet above the water table is recommended to be a MnDOT 3149.2B2 Select Granular Borrow modified so that no more than five percent by weight of the material passes the US No. 200 sieve. Compaction of the modified Select Granular Borrow is recommended to be in accordance with the Quality Compaction Method of MnDOT 2105. Embankment fill and replacement fill placed above the modified Select Granular Borrow can be suitable common borrow material.

5.6 West Approach Embankment

The west approach embankment will extend from Station 975+00 to the west bridge abutment at approximate Station 983+76. The NW retaining wall extends along the north side of the embankment from Station 979+25 to the west abutment. Side slopes along the main alignment range from 2H:1V to 4.6H:1V; outer fill slopes along the ramp sections will be as steep as 2H:1V. The maximum embankment height will be approximately 15 feet above existing grade at the west abutment.

Similar to the east approach embankment area, compressible organic soils consisting of peat and organic clay and silt were encountered beneath variable fill soils within the west embankment footprint. However, unlike beneath the east embankment, the organic soils and underlying outwash sands beneath the west approach embankment are known to contain elevated levels of contamination. The Phase II investigation identified that the contaminant concentrations are above standard soil reference values established by the Minnesota Pollution Control Agency (MPCA). Additional cost would be associated with the disposal of the soil from this area.

A Value Engineering Study Report dated August 10-13, 2010, which was commissioned by MnDOT and prepared by HDR Engineering, Inc., suggested the option of employing a pile supported embankment design as one of three alternative options for fill areas west of Louisiana Avenue. The other two options included 1) use of lightweight fill within embankment fill, and 2) use of ground improvement techniques such as deep soil mixing, stone columns, vibrocompaction, etc. A pile supported embankment design was deemed the best fit for this project because A) it poses less risk associated with long term embankment settlements even when using lightweight fill, and B) a specialty contractors, which are typically required for the various ground improvement methods presented in the report, would not be needed. Please refer to the HDR report for further discussion regarding alternative options.

5.7 Pile Supported Embankment

Although pile supported embankments have seen wide use in the United States, at the outset of this project's design, only one such embankment had been constructed in Minnesota (TH 241 in St. Michael in 2005). The TH 241 pile supported embankment was designed by Jim Collin of The Collin Group, Inc., under contract to MnDOT, and the plans were prepared by the MnDOT Foundations unit.

In general, the function of a pile supported embankment is transfer the load from new embankment fill via steel piles to a firm bearing stratum below poor soils. The two primary design concerns are: 1) determining the site's capacity to support pile foundations, and 2) designing the Load Transfer Platform that conveys the embankment load to the piles.

Many publications exist that discuss the history, design, and performance of pile supported embankments. The paper, "Column Supported Embankment Design Considerations" by Dr. Jim Collin was used as the primary basis for this evaluation. Additionally, MnDOT Foundations personnel were consulted and provided input based on their experience with the TH 241 project.

5.7.1 Pile Foundations and Pile Caps

Similar to the bridge and retaining walls, HP 12x53 non-displacement piles composed of A572 steel are recommended for support of the west approach embankment. The piles should be driven to bear on competent bedrock. Based on borings R-1 to R-4, which were drilled west of Louisiana Avenue, the top of the Platteville Limestone is estimated to be at approximate elevation 818 to 820 (see Table 2 for a summary of bedrock elevations). Outer piles not adjacent to the retaining wall should be battered 1H:4V. Per Table 10.2.1 from the MnDOT LRFD Bridge Design Manual, the factored design load for the piles should be limited to 140 tons.

To the extent possible, the pile cap elevations beneath the west embankment should be equivalent to the pile caps for the adjacent NW retaining wall. Assuming a maximum fill height of 15 feet and a maximum bury depth of 5 feet for the retaining wall foundation, a height of 20 feet was used as a basis to determine the embankment design load to be imparted to the piles below the west embankment. For a square pile layout (i.e. perpendicular rows of piles) and a pile spacing of 10 feet, the maximum design load per pile is 133 tons. Pile caps should have a minimum dimension of 24 inches. The outside edge of the outermost pile caps should be no more than 18 feet from the toe of the embankment.

A global stability analysis was performed to assess edge stability of the embankment slope outside of the pile supported footprint. MnDOT and FHWA guidelines for reinforced soil slopes require a minimum factor of safety (FS) of 1.3 with respect to external stability. In considering the outer portions of the pile supported embankment to be a form of reinforced soil slope due to the presence of geosynthetic elements required for the LTP (discussed below), the minimum required FS was increased to 1.5 due to the presence of organic soil deposits that vary in thickness and shear strength. By requiring that the outside edge of the outermost pile cap to be located no more than 18 feet from the embankment toe, a FS of 1.5 was calculated with respect to global (external) stability.

In order to provide reinforcement against edge stability failures and to counteract the potential for lateral spreading of the embankment over weak organic soils, placement of a geosynthetic elements are required. The geosynthetic elements are discussed in more detail in the following section. Recommended design properties are provided in Table 5b.

5.7.2 Load Transfer Platform (LTP)

In order to transmit the embankment load to the pile caps, a Load Transfer Platform (LTP) must be constructed. In accordance with the Collin Method, the LTP is assumed to function as a beam or platform facilitating the load transfer. Performance is predicated on fully developed soil arching occurring within the LTP. The Collin Method requires that the design thickness of the LTP be no less than one half the clear span distance between pile caps. The method also requires an assumption of the soil arching angle within the platform. Provided a suitable well-graded material is used as backfill within the LTP, the standard of practice indicates that arching can be assumed to occur at an angle of 45 to 60 degrees (as measured from the horizontal plane).

In practice, the LTP is a reinforced soil mass consisting of geosynthetic layers and well-graded select fill. The geosynthetic layers provide confinement for the select fill so that soil arching develops within the design thickness of the LTP. The Collin Method stipulates that a minimum of three (3) layers of geosynthetics (typically geogrids) be employed within the select fill and that a base geosynthetic (typically a reinforcement geotextile) be deployed at the bottom of the LTP on top of the pile caps. The geogrids and reinforcement geotextile are designed using equations provided by the Collin Method that are based on tension membrane theory.

Based on a square pile spacing of 10 feet and pile cap width of 2 feet, the LTP is recommended to be a minimum of 4 feet thick. Backfill within the LTP is recommended to be a MnDOT 3138 Class 5 aggregate base material and should be compacted in accordance with MnDOT 2451.

For a 4-foot thick platform, the geogrids should be spaced 12 inches apart, with the bottom geogrid no more than 12 inches above the base reinforcement geotextile. The geogrids are recommended to be biaxial geogrids with minimum values specified in both the machine and cross machine directions for the tensile strength at 2% strain and the tensile strength at 5% strain. Similarly, the base reinforcement geotextile is recommended to have minimum values specified in both the machine and cross machine directions for the tensile strength at 2% strain and the tensile strength at 5% strain. It is recommended that the base reinforcement geotextile be placed in continuous panels perpendicular to the embankment centerline. The geogrids are recommended to be placed in alternating layers both parallel to and perpendicular to centerline (i.e. the top and bottom layers aligned parallel with the middle aligned perpendicular). Overlap of adjacent layers is recommended to be a minimum of 18 inches. The base reinforcement geotextile is recommended to extend from toe to toe and the geogrids are recommended to extend all the way through to the slope face. For situations where a portion or all of the LTP will be below final grade, the geogrids and the base geotextile are recommended to extend laterally to the same offset distance as the embankment toe.

Table 5a
Recommended Material Properties for LTP Geogrids.

Property	MD ¹	CD ¹	Units	Test Method
Minimum Tensile Strength at 2% Strain	600	600	pounds per foot	ASTM D6637
Minimum Tensile Strength at 5% Strain	400	400	pounds per foot	ASTM D6637
Minimum Coefficient of Interaction, Ci	0.8		n/a	ASTM D6706

¹ MD = Machine Direction (also referred to as Roll Direction), CD = Cross Machine Direction

Table 5b
Recommended Material Properties for LTP Base Geotextile¹.

Property	MD ²	CD ²	Units	Test Method
Minimum Tensile Strength at 2% Strain	600	600	pounds per foot	ASTM D6637
Minimum Tensile Strength at 5% Strain	400	400	pounds per foot	ASTM D6637
Minimum Coefficient of Interaction, Ci	0.8		n/a	ASTM D6706
Minimum Permittivity	0.1		sec ⁻¹	ASTM D4491

¹ The Base Geotextile required in both LTP design and lateral spreading evaluation should be the same product.

Properties provided satisfy recommendations for both applications.

² MD = Machine Direction (also referred to as Roll Direction), CD = Cross Machine Direction

5.8 West Embankment Ramps and Temporary Bypass

The northwest and southwest ramps along the west approach embankment will be constructed on fill areas over compressible organic soils. Up to 8 feet of fill is expected to be placed in the ramp areas. Also, prior to construction of the pile supported west approach embankment, a temporary bypass alignment will be constructed on fill along the south edge of the project for the purposes of maintaining TH 7 traffic. Up to 3 feet of fill is expected to construct the temporary bypass.

The final grades along the west embankment ramps and bypass areas are at lower elevations than the final grades along centerline of the main approach embankment. Any pile support of these areas in conjunction with the main embankment would require additional excavation beneath the main embankment in order to keep the pile caps and LTP at consistent elevations. A consistent LTP elevation is necessary in order to maintain continuous geosynthetic elements within the LTP. Any additional excavation beneath the main embankment would likely penetrate into contaminated soils. Therefore the ramp and bypass fill areas are recommended to receive embankment surcharges.

5.8.1 Surcharges

As the ramp embankment areas cannot be incorporated into the main pile supported section, it is recommended the underlying compressible soils be surcharged prior to final grading and pavement construction. Without surcharging (also referred to as preloading or pre-compression), settlements of up to 15 inches are expected due to primary consolidation with an additional 5 inches of settlement due to secondary compression occurring over the long term, or approximately 50 years.

The surcharge sections are recommended to compress the underlying organic soils beyond the primary consolidation and secondary compression estimates. Surcharge heights are recommended to consist of 5 feet of fill placed above final embankment grade. The surcharge fill should be a suitable non-organic material with a minimum in-place unit weight of 120 pcf (pounds per cubic foot). Placement of fill over compressible organic and cohesive soils results in build-up of excess pore pressures that can cause slope instability. A reinforcement geotextile is recommended at the base of embankment fills in surcharge areas to provide additional resistance against slope instability.

With a reinforcement geotextile, a FS of at least 1.3 with respect to slope stability was calculated for a full height surcharge embankment assuming undrained (i.e. end of construction) conditions. Surcharge fill is recommended to be placed in staged lifts wherein subsequent lifts are placed upon dissipation of excess pore pressures that resulted from the previous lift. Excess pore pressures and settlement are recommended to be monitored

throughout the surcharge period. Refer to Construction Monitoring and Instrumentation section below for discussion regarding monitoring of surcharge settlement and excess pore pressures.

The locations (by station), estimated time of surcharge, and estimated total settlement due to both primary consolidation and secondary compression for each surcharge area are provided in Table 6.

Table 6
Surcharge Summary

Surcharge Area	Stations	Estimated Total Settlement (in.)	Estimated Surcharge Period (days)
NW Ramp	976+50 to 981+00	20	46
SW Ramp	975+00 to 981+00	18	47
Temp. Bypass	979+50 to 983+54 ¹	14	30

¹ Approximate station at intersection with Louisiana Avenue

5.9 Pavement and Subgrade

Outside of the bridge approach and ramp embankment fill areas, existing subgrade soils consisted primarily of sandy fill with varying amounts of silt and loam. R-value tests were conducted on two samples of sandy loam fill. The samples were from B-3 and B-13, respectively located west and east of the proposed approach embankments along TH 7. R-value testing returned values of 28 and 71 from B-3 and B-13, respectively. Because of the wide variability within existing fill material, the lower R-value of 28 was used as the basis for evaluation of pavement support.

Evaluation of pavement support considered traffic data for TH 7 and Louisiana Avenue using 2010 as the base year and 2030 as the design year. Equivalent single-axle loads (ESAL) were calculated using criteria provided in the MnDOT Pavement Manual for the seven county Twin Cities area. The ESAL and R-value parameters were used in conjunction with Table 5-3.7 from the MnDOT Pavement Manual to determine the required Granular Equivalent (GE) for TH 7 and Louisiana Avenue pavement sections. Assuming minimum bituminous and aggregate base sections for both TH 7 and Louisiana Avenue, it is recommended to incorporate a 1.5 foot (18 inch) subcut backfilled with MnDOT Select Granular Borrow in order to satisfy the total required GE. Table 7 provides a summary of the pavement evaluation.

Table 7
Summary of Pavement Evaluation

	TH 7	Louisiana Avenue ¹
AADT, 2010	35,000	12,400
AADT, 2030	40,000	20,900
20-yr ESAL	7,128,000	3,163,000
R-value	28	28
Required Total GE	31	29
Minimum Bituminous GE	16	14
Minimum Aggregate Base GE	6	6
Required Additional GE	9	9
Recommended Subcut ²	1.5 ft	1.5 ft

¹ The pavement section for Louisiana Avenue is also recommended for Walker Street, W. Lake Street, and W. 37th Street

² Backfilled with MnDOT 3149.2B2 Select Granular material

5.10 Utilities

Existing sanitary sewer, water main, and force main lines will be removed and replaced (the force main service carries contaminated groundwater to a City-operated pump house). All three new utilities are proposed to be re-aligned along Louisiana Avenue, pass beneath the new bridge, and remain outside of pile support, surcharge, and most muck excavation areas. Only a segment of force main line approximately 250 feet long will intersect a portion of the recommended east approach embankment muck excavation. The depth of the new utilities is expected to be between 5 to 10 feet below finished grade, or approximately elevation 880-885.

Deposits of organic soils between 8 and 13 feet thick were identified in borings performed as part of multiple subsurface investigations (see Table 8). Utilities supported within or over organic soils can experience unacceptable deflections. It is recommended to either A) excavate the organic soils from beneath the utilities and replace with suitable compacted fill and bedding, or B) support the utilities on a deep foundation system such as steel piles or helical piles. In general, it is recommended to align utilities as much as possible beneath the center of Louisiana Avenue to minimize overlap with either the muck excavation or pile support installation. Construction of the force main segment within the muck excavation south of TH 7 will need to be staged and coordinated with that effort. Table 8 presents a summary of the soil conditions for borings located along the new utility alignments.

Table 8
Utility Soil Conditions (approx. north to south along Louisiana Ave.)

Boring	Approx. Surface Elev.	Approx. Bottom Elev. Of Org. Soils	Thickness of Org. Soils (ft)	Notes
ST-5 ¹	893.6	881.6	10	<ul style="list-style-type: none"> Slightly organic fill with peat Slightly organic soft clay
GP-9 ²	895.0	880.0	8	<ul style="list-style-type: none"> Slightly organic sand and clay fill Peat Foreign odors detected Significant sheen noted on soil and groundwater
GP-8 ²	896.0	875.0	13	<ul style="list-style-type: none"> Slightly organic sand and clay fill Peat Organic silt
B-10 ³	896.2	877.2	12	<ul style="list-style-type: none"> Organic clay fill Peat
R-6	897.0	870.0	10	<ul style="list-style-type: none"> Peat Slightly organic clay (very soft to firm) Foreign odors detected
R-5	897.0	n/a	n/a	<ul style="list-style-type: none"> No organic soils encountered
GP-16 ²	888.0	872.5	11.5	<ul style="list-style-type: none"> Peat Organic silt
ST-1 ¹	891.4	873.4	10	<ul style="list-style-type: none"> Peat Organic clay Foreign odors detected

¹ 2004 Subsurface Investigation by Braun Intertec for City of St. Louis Park

² 2010 Phase II Investigation

³ 2009 Subsurface Investigation by Braun Intertec for SEH

5.11 Ponds

New stormwater ponds will be situated in the northeast and southeast quadrants. Geosynthetic liners will be installed at both ponds. The liners are required to maintain separation of groundwater and stormwater. Both ponds will maintain a minimum permanent water level. Excavation for both ponds will occur within and adjacent to the east approach embankment. Perform excavation for ponds in accordance with the recommendations provided herein for muck excavation.

6.0 Construction Monitoring and Instrumentation

6.1 Construction Monitoring

Monitoring during construction will be critical for the pile supported embankment and surcharge embankments. Construction of these features requires that special instrumentation be installed to record data and that a monitoring program be developed to collect and evaluate the data. The following provides recommendations for type of instrumentation, installation details, and data evaluation. All instruments discussed are capable of continuously recording data to an automatic data logging system.

6.1.1 Load Transfer Platform

A key requirement for acceptable performance of the pile supported embankment is that all of the vertical embankment load above the LTP must be transferred to the pile caps. Field measurement of this load transfer can be accomplished in a few different ways, using earth pressure cells, piezometers, geotextile strain gages, or the ShapeAccelArray™ system. Use of at least two different instrument types is recommended for redundancy so that estimates of load transfer from one device can be correlated and confirmed to those of another device.

6.1.2 Embankment Surcharges

Measurements of excess pore pressure and settlement are important when constructing surcharges. Excess pore pressures are typically recorded using piezometers. Settlement plates are simple and economical devices for monitoring settlements beneath embankments.

6.2 Instrumentation

6.2.1 Earth Pressure Cells

Measurement of non-hydrostatic force and stress within soil materials is typically accomplished with earth pressure cells (EPCs). As it is not technically possible to measure actual stress, EPCs estimate stress by one of two ways: 1) using a strain gage to measure the strain imposed on an internal diaphragm due to external loads and then converting the strain to stress, and 2) using a pressure transducer to directly measure the change in hydrostatic pressure imposed on a fluid-filled cell. Field stress measurements are dependent on many factors, such as the geometry of the measuring device, its relative stiffness compared to the surrounding material, and its method of calibration. For example, EPCs fabricated with a rigid casing will typically record a lower stress as load is shed to the ridged casing and away from the measuring diaphragm, leading to an under-registration of the true in-situ stress field. These factors can be accounted for with appropriate laboratory calibration of the EPC under conditions expected to mimic those to be encountered in the field.

For the pile supported embankment, EPCs are recommended to be installed at four typical locations: 1) directly above the pile cap at the bottom of the LTP, 2) directly above the pile cap at the top of the LTP, 3) between pile caps at the top of the LTP, and 4) between pile caps at the bottom of the LTP. A report prepared for MnDOT by the University of Minnesota

documented the instrumentation and performance of the TH 241 pile supported embankment. EPCs were installed as part of that study and they indicated that the majority of the load transfer to the pile caps occurred above – and not within – the LTP.

6.2.2 Piezometers

When fill is placed over soil under saturated conditions, the vertical load from the fill is immediately transferred to the surrounding groundwater where it is manifested as excess pore pressure. In granular soils, the excess pore pressure dissipates quickly. In cohesive soils, such as peat and organic silt and clay, the dissipation occurs over time and allows field measurements to be made.

Piezometers are recommended to be installed within the organic soils beneath surcharge areas. The buildup and dissipation of excess pore pressures provide an indication of consolidation progress and how fast or slow staged fill placement should progress. Fill that is placed too fast and to too great of a height can risk failure of the underlying compressible soils. Therefore monitoring of pore pressure increases and dissipation with time is critical to field decisions regarding staging of fill placement and prevention of embankment failure.

Piezometers should be installed between pile caps, within the underlying organic soils, and monitored during fill placement. Any increases in pore pressure that are detected could be an indication of embankment loads not being fully transferred to the pile caps.

6.2.3 Geotextile Strain Gages

Strains within geotextiles can be measured via a series of strain gages. Strain measurements from individual gages can be used to provide an estimate of the overall strain in the geotextile. The estimate of overall strain is converted to a corresponding estimate of stress, which is then compared to design assumptions.

Strategically placed gages within the LTP base reinforcement geotextile can be used to provide indications of whether soil arching is occurring within or above the LTP. Any strains that develop during construction, after much of the embankment has been placed, may indicate that arching is not occurring. Strain gages should be placed in clusters on both the bottom and top of the base reinforcement geotextile, located both over pile caps and midway between pile caps, and aligned in both parallel and perpendicular to embankment centerline. A minimum of two clusters are recommended for purposes of redundancy with other instruments and as backup in the event one or more gages at a clusters fail.

6.2.4 ShapeAccelArray™ System

The ShapeAccelArray (SAA) system is a cylindrical array of jointed sensors contained in a flexible casing. The sensors consist of orthogonally-aligned accelerometers that are capable of continuously recording displacements in three dimensions. In geotechnical applications, SAA systems are typically used to measure slope movements (similar to an inclinometer) and vertical deflections beneath embankments. MnDOT owns a number of SAA devices that have been used with well known success on various projects, including the TH 2 landslide in Crookston, Minnesota.

SAA systems could be installed horizontally at the bottom, top, and middle of the LTP, as well as beneath surcharges for the purposes of measuring vertical deflections. Any deflections measured could be evaluated to assess efficiency of load transfer to the pile caps and soil arching, as well as converted to estimates of strain within the LTP geosynthetic elements. SAA can also provide vibration data, which may be advantageous considering the

quantity and extent of piles proposed to be driven for the bridge, retaining wall, and pile supported embankment.

6.2.5 Settlement Plates

Settlement plates are simple and economical devices used to measure settlement of compressible soils beneath embankments. Settlement plates are recommended for all surcharge areas.

6.2.6 Vibration Sensors (Geophones) and Noise Sensors

Given the quantity of piles proposed to be driven at the site, a vibration and noise monitoring program should be considered. Such a program should include a pre-condition survey of selected structures for each aspect of construction to be monitored (e.g. vibrations, structure movement during dewatering). The pre-condition survey should include, but not be limited to, a visual documentation of existing structural cracks and a baseline elevation survey of structures and ground monuments. This includes the recommended televising and/or pressure testing of existing utilities.

7.0 General Conditions and Considerations

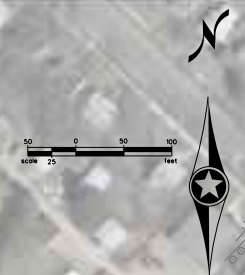
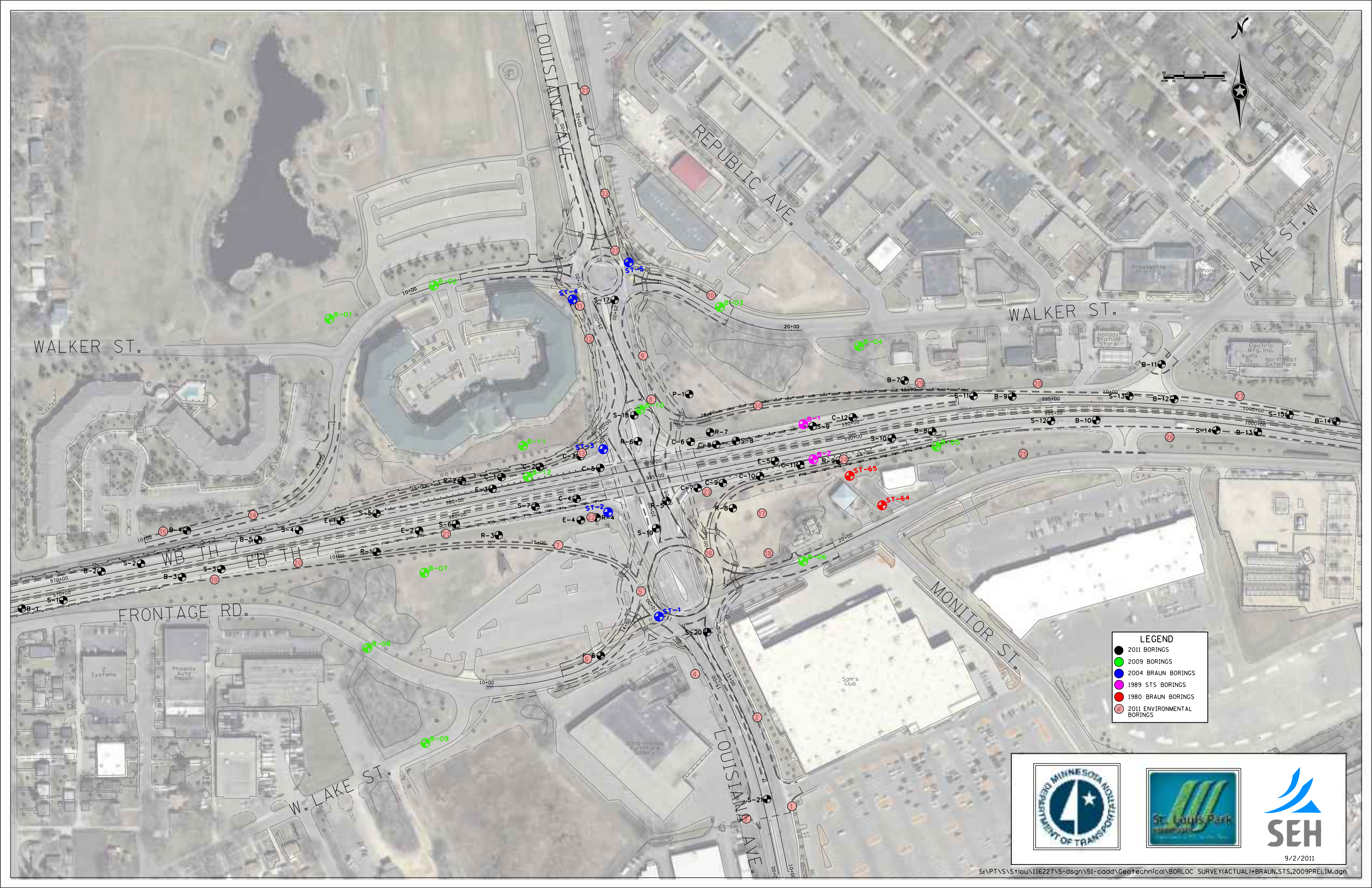
This report has been prepared in order to assist the City of St. Louis Park and SEH in design of the proposed interchange. The scope is limited to the specific project and location described herein, and the description of the project represents an understanding of the significant aspects relevant to geotechnical characteristics. In the event that any changes in the project layout, as outlined in this report, are planned the conclusions of this report should be reviewed and modified in writing.

The analysis and recommendations submitted in this report are based on the data obtained from specific soil borings drilled through existing public right-of-way areas, and from other available information discussed in this report. This report does not reflect any variations that may occur between these borings, variations that may occur outside of public right-of-way areas, or variations occurring near structural foundations at adjacent private and commercial properties.

During a subsurface exploration, specific information is obtained at specific locations and at specific times. However, it is a well-known fact that variations in soil and groundwater conditions may not become evident until the course of construction. If variations then become evident, it will be necessary for a re-evaluation of the recommendations in this report after performing on-site observations during construction and noting the characteristics of any variations.

Appendix A

Boring Location Map



LEGEND

- 2011 BORINGS
- 2009 BORINGS
- 2004 BRAUN BORINGS
- 1989 STS BORINGS
- 1980 BRAUN BORINGS
- 2011 ENVIRONMENTAL BORINGS







9/2/2011

Appendix B

Braun Soil Boring Report, 2011

Results of Soil Borings and Laboratory Testing

TH 7 and Louisiana Avenue Reconstruction
St. Louis Park, Minnesota

Prepared for

Short Elliott Hendrickson, Inc.

Project BL-09-00745A
September 26, 2011

Braun Intertec Corporation

September 26, 2011

Project BL-09-00745A

Mr. Brent Theroux, PE
Short Elliott Hendrickson, Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110

Re: Soil Borings and Laboratory Testing
TH 7 and Louisiana Avenue Reconstruction
St. Louis Park, Minnesota

Dear Mr. Theroux:

We have completed the soil borings and laboratory testing requested by Short Elliott Hendrickson, Inc. (SEH) for the reconstruction of Trunk Highway 7 (TH 7) and Louisiana Avenue in St. Louis Park, Minnesota.

Scope of Services

Our work was completed in general accordance with our Proposal for Soil Borings and Laboratory Testing to SEH, dated May 23, 2011 and SEH authorized scope changes.

For the project, our scope of services included the following:

- Site reconnaissance and onsite meeting with SEH to coordinate access.
- Clearance of public utilities.
- Acquiring a MnDOT Trunk Highway Right-of-Way and City of St. Louis Park Public Works Permits.
- Coordination of traffic control in accordance with the approved permits.
- Performing twenty auger borings in pavement areas to nominal depths of 5 to 10 feet below grade.
- Performing fourteen standard penetration test (SPT) borings in road areas to a nominal depth of 20 feet below grade.
- Performing five SPT borings in embankment areas to a nominal depth of 40 feet below grade.
- Performing nine SPT borings in bridge, retaining wall and embankment areas to a nominal depth of 70 feet below grade (or auger refusal).
- Performing one SPT boring in a pond area to a nominal depth of 15 feet below grade.
- Performing rock coring to a nominal depth of 10 feet below auger refusal at the nine 70-foot SPT borings in bridge, retaining wall and embankment areas.

- Performing twelve cone penetration test (CPT) soundings to a nominal depth of 70 feet below grade (or to cone refusal).
- Collecting excess drilling fluid and soil cuttings, placing in steel drums and moving to an onsite location for temporary storage and disposal by the owner.
- Laboratory testing as requested by SEH.
- Preparation of this factual soil boring report.

Documents Provided

SEH provided us with an aerial figure of the project area denoting the boring locations. The figure was titled TH 7/Louisiana and was dated February 2011.

For the purposes of this report, SEH provided us with an untitled soil boring location map reflecting the surveyed boring locations. A copy of this map is included in Appendix A for reference.

Boring Locations and Elevations

As requested, we performed a total of twenty auger borings, twenty-nine SPT borings and twelve CPT soundings. The borings were performed and named as listed in Table 1.

Table 1. Boring and Sounding Summary

Boring Type	Quantity	Location	Unique Name
CPT	12	Embankment/Bridge/Retaining Wall	C-1 to C-12
Auger	20	Pavement Areas	S-1 to S-21*
SPT	5	Embankment Areas	E-1 to E-5
SPT	1	Pond	P-1
SPT with Coring	9	Embankment/Bridge/Retaining Wall	R-1 to R-9
SPT	14	Road	B-1 to B-14

*Note: S-16 was omitted from scope.

The borings were performed at the approximate locations shown on the attached soil boring map provided by SEH.

The boring locations were selected and staked by SEH. Boring coordinates and ground surface elevations at the boring locations were provided by SEH.

Drilling and Sampling

Auger Borings

Auger borings were drilled with truck-mounted core and auger drills with solid stem auger in accordance with ASTM D 1452.

Standard Penetration Test Borings

The SPT borings were drilled with off-road vehicle and truck-mounted core and auger drills equipped with hollow-stem auger in accordance with ASTM D 1586. A 110-pound calibrated hammer was used for the borings. The 110-lb hammer for Drill Rig 7514 was calibrated to 63 percent efficiency on June 10, 2010, the hammer for Drill Rig 7506 was calibrated to 62.2 percent efficiency on January 6, 2011 and the hammer for Drill Rig 7503 was calibrated to 68.5 percent efficiency on November 12, 2010.

During drilling, penetration test samples were taken at 2 1/2- and 5-foot intervals. Thinwall samples were attempted in areas where cohesive or organic soils were encountered at Borings E-1 to E-5 and R-1 to R-9. Actual sample intervals and corresponding depths are shown on the boring logs.

Rock Coring

Coring of the bedrock was performed with off-road vehicle and truck-mounted core drills in general accordance with ASTM D 2113. Rock cores were taken with an NQ-3 core barrel. The bit and casing were first lowered to the bottom of the previously advanced borehole. The core barrel was then lowered into the casing with a wire line, and locked into place. The bit and barrel were advanced by rotating the assembly while applying pressure. Bentonite drilling mud was used to cool the bit and wash cuttings to the surface.

After each 5-foot core run was completed, the core barrel was unlocked from the bit and brought to the surface. The split inner tube was then extruded from the barrel and opened to reveal the core sample. After field classification and logging, the core was packed into a 5-foot wooden storage box.

Cone Penetration Test Soundings

The CPT soundings were performed with an off-road CPT rig by advancing a Vertek piezocone with pore pressure and seismic capabilities. The soundings were performed in accordance with ASTM D 5778. As the cone was advanced, tip resistance (Q_t), sleeve friction (F_s) and pore pressure (U_2) were measured continuously.

Sample Storage

Representative soil and rock samples will remain in our Minneapolis office for a period of 60 days to be available for your examination.

Log of Boring Sheets

Log of Boring sheets for our SPT and auger borings, including rock coring, are included in Appendix A of this report. The logs identify and describe the geologic materials that were penetrated, present the results of penetration resistance tests (for the penetration test borings), laboratory tests performed on penetration test and auger samples retrieved from them, and groundwater measurements. Provided rock coring information includes percent recovery, rock quality designation (RQD), average core length (ACL) and cores breaks per foot.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions.

Cone Penetration Test Sounding Logs

CPT Sounding Logs are included in Appendix B of this report. The CPT sounding logs report the tip resistance, sleeve friction and pore pressure that was measured continuously by the cone as it was advanced. The normalized friction ratio, undrained shear strength, and soil behavior type were calculated from the raw data. The graphical SBT is based upon the relationship between normalized tip resistance and friction ratio (Robertson 1990). Direct observation of the soils does not occur with CPT soundings.

Soil and Rock Classification

The soils encountered were visually and manually classified in general accordance with the MnDOT Triangular Textural Soil Classification System. A chart explaining the classification system is attached. Supplemental to the chart, soil containing more than 50 percent gravel by weight was classified as Gravel. Classification of recovered rock cores was based on US. Army Corps of Engineers EM 1110-1-2908.

Laboratory Testing

Testing Performed and Procedures

Laboratory testing was performed as requested by SEH. For Borings E-1 to E-5 and R-1 to R-9, testing was performed in general accordance with the MnDOT Specifications for Subsurface Investigation (except as listed below). Tests performed included moisture content, organic content, sieve analysis, Atterberg limits, hand penetrometer, unconfined compression, unconsolidated-undrained triaxial shear (U-U test), consolidation, standard Proctor and R-value tests on recovered jar, thinwall and bag samples (of auger cuttings). Tests were performed in accordance with MnDOT or ASTM procedures and as referenced on the specific test reports.

The tests are shown or noted on the right side of the Log of Boring Sheets, across from the associated sample. Moisture content, dry density and cohesion results listed on the Log of Boring sheets are typically derived from the unconfined compression test results. Where only a U-U test was performed (on a thinwall sample) due to limited sample recovery or quality, the moisture content, dry density and cohesion included on the Log of Boring Sheet were derived from the U-U test.

The sieve analysis, Atterberg limits, unconfined compression, U-U test, consolidation, standard Proctor and R-value tests test results are shown graphically on separate sheets included in Appendix C of this report.

Exceptions

As noted on the boring logs, laboratory testing was not performed on several borings in general accordance with the MnDOT Specifications for Subsurface Investigation (or as requested by SEH) due to contamination within the recovered samples. Borings where this situation occurred included Borings R-1, R-2 and R-3.

Where unconfined compression and U-U tests were both requested on a thinwall sample, the U-U test was performed first, and the unconfined compression test was not performed if the remaining sample was insufficient for testing. A requested consolidation test was also not performed on the thinwall sample from 29 to 31 feet at Boring R-4 due to insufficient sample after unconfined compression and U-U testing.

Testing (moisture content) was also not performed in accordance with the MnDOT Specifications for Subsurface Investigation on a few samples from Borings R-1 and R-2 as a result of the samples being accidentally discarded prior to completion of these tests.

Groundwater Observations and Borehole Abandonment

The drillers checked for groundwater as the penetration test borings were advanced. The borings were typically checked again for the presence of groundwater after auger withdrawal, unless mud rotary drilling methods or coring was performed. The boreholes were then backfilled with cuttings and/or bentonite grout after completion in accordance with Minnesota Department of Health regulations.

As requested by SEH, excess soil cuttings and drilling fluid generated during completion of the borings was collected and placed in steel drums. The drums were labeled and dated and moved to the City owned parking lot on the southwest corner of TH 7 and Louisiana Avenue. Braun Intertec holds no responsibility for the storage or disposal of the cuttings after collection and placement at the designated storage location.

Groundwater Fluctuations

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation period was relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

Level of Care

In performing our services, Braun Intertec has used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of our profession currently practicing in the same locality. No warranty, express or implied, is made.

General

Please refer to the attached report for a detailed summary of our procedures and results. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding this report, please contact Josh Van Abel at 952.995.2310 or Matt Ruble at 952.995.2224.

Sincerely,

BRAUN INTERTEC CORPORATION



Joshua J. Van Abel, PE
Associate – Senior Engineer



Matthew P. Ruble, PE
Principal Engineer

Appendix A:

Soil Boring Location Map (Provided by SEH)
Log of Boring Sheets B-1 to B-14 (SPT)
Log of Boring Sheets E-1 to E-5 (SPT)
Log of Boring Sheet P-1 (SPT)
Log of Boring Sheets R-1 to R-9 (SPT)
Log of Boring Sheets S-1 to S-21, excluding S-16 (Auger)

Appendix B:

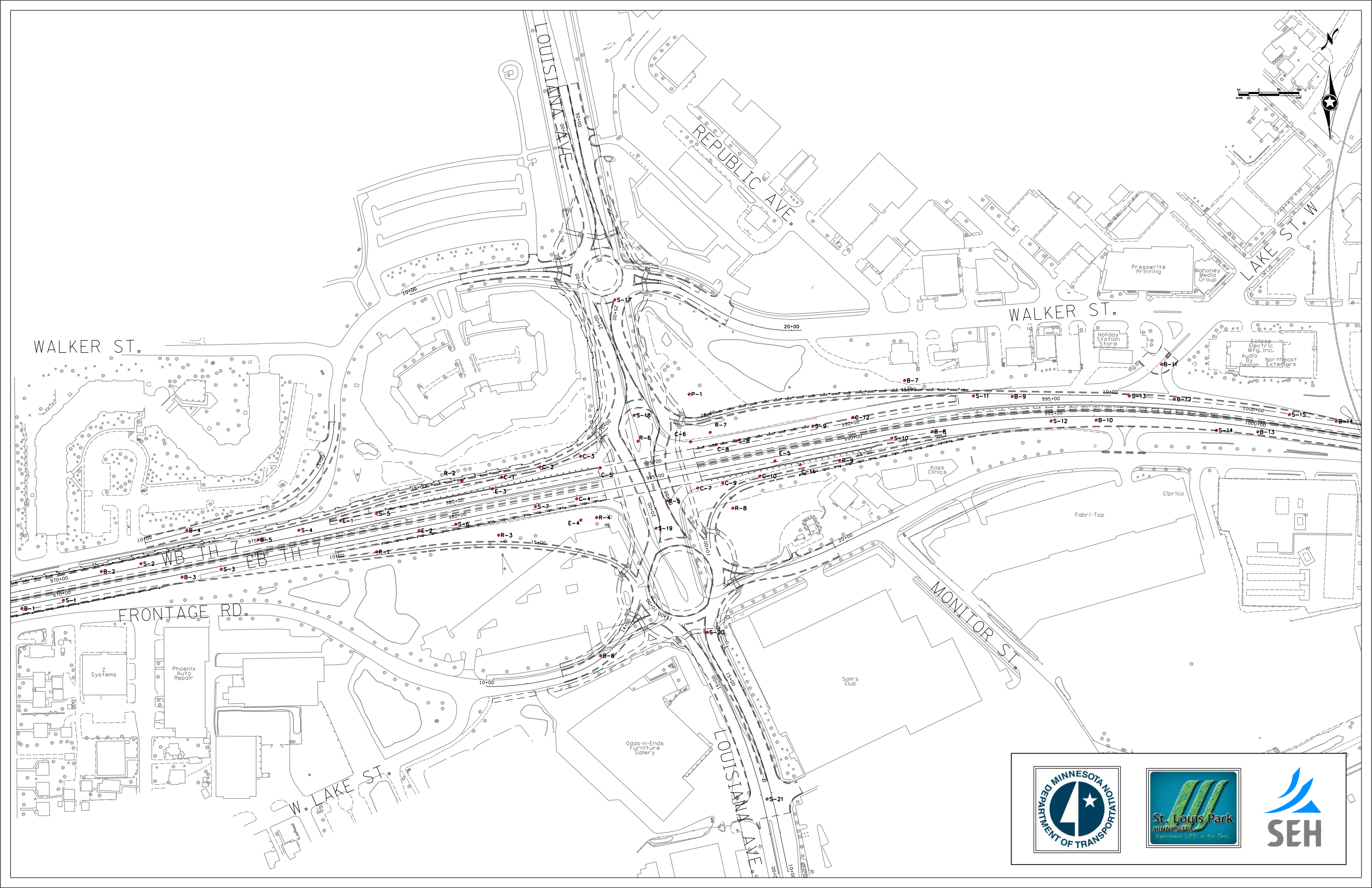
Cone Penetration Test Results C-1 to C-12

Appendix C:

Grain Size Accumulation Curves (59 Sheets)
Atterberg Limits Result (1 Sheet)
Consolidation Test Reports (6 Sheets)
Unconfined Compression Test Reports (15 Sheets)
Unconsolidated-Undrained Test Reports (8 Sheets)
Moisture-Density Relationship Reports (Standard Proctor – 2 Sheets)
Material Test Reports (R-Value – 2 sheets)
Descriptive Terminology of Soil

Soil Boring Rpt

Appendix A



MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-1		915.0 (Surveyed)		
Location Co. Coordinate: X=502015 Y=153177 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.0 914.0		12 1/2 inches Bituminous.							
	2.0 913.0		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
5			SAND, fine to coarse grained, trace Gravel to with Gravel, light brown, moist. (Possible Fill)		24	3				P200=6% See Grain Size Accumulation Curve.
	7.0 908.0				14					
10			SAND, fine to coarse grained, with Gravel, with possible Boulders, brown, moist, medium dense. (Glacial Outwash)		12					
	12.0 903.0				17*					*No sample recovery, sample from cuttings.
15					17					
					27					
			SAND, fine to coarse grained, with Gravel, light brown, wet, medium dense to dense. (Glacial Outwash)		22					
20					15					
	21.0 894.0		Bottom of Hole - 21 feet. Water not observed with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 14 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled.							

BRAUN
INTERTEC



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-2		905.9 (Surveyed)		
Location Co. Coordinate: X=502212 Y=153269 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil Rock	Other Tests Or Remarks
	Elev.				N60	(%)	(psf)	(pcf)		REC
	1.1		13 inches Bituminous.							
	904.8		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)			3				P200=12% See Grain Size Accumulation Curve.
	2.0									
	903.9		SANDY LOAM, plastic, trace Gravel, brown and dark brown, moist to wet. (Fill)		19					
	4.0									
	901.9		CLAY, with Loamy Sand seams, brown and dark brown, wet. (Fill)		10	18				
5	6.0									
	899.9									
10			SANDY LOAM, with Gravel, with possible Boulders, slightly plastic, brown and dark brown, moist to wet. (Fill)		50*/2"					*No sample recovery.
	14.0									
	891.9									
15										
			SAND, fine to coarse grained, trace Gravel, brown, waterbearing. (Fill)		20					
	17.5									
	888.4									
	18.5		PEAT, semi-fibrous, dark brown, wet. (Swamp Deposit)		7	31				
	887.4									
			SANDY LOAM, non plastic, with Gravel, dark brown, waterbearing, medium dense. (Alluvium/Glacial Till)		16					
20										
	21.0									
	884.9		Bottom of Hole - 21 feet. Water observed at 14 feet with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 17 feet immediately after withdrawal of auger. Boring immediately backfilled.							

Index Sheet Code 3.0

Soil Class:J. Van Abel Rock Class: Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-3		900.2 (Surveyed)		
Location Co. Coordinate: X=502412 Y=153254 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.1		13 1/2 inches Bituminous.							
	899.1		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
	2.0									
	898.2				29	8				P200=27% See Grain Size Accumulation Curve.
5			SANDY LOAM, slightly plastic, with Gravel, with Loamy Sand seams, non to slightly organic, black, dark brown and brown, wet. (Fill)		19	10				OC=2%
	7.0									
	893.2		CLAY, slightly organic, with Loamy Sand seams, black and brown, wet. (Fill)		8	15				
	9.0									
10	891.2		SAND, fine to coarse grained, with Gravel, light brown, moist. (Fill)		24					
	12.0									
	888.2		LOAMY SAND, fine to coarse grained, with Gravel, dark brown, moist. (Fill)		39					
	14.0				19					
15	886.2									
			SAND, fine to coarse grained, with Gravel, brown, waterbearing, medium dense to dense. (Glacial Outwash) With Sandy Loam seams at 18 feet.		19					
					19					
20										
	21.0				28					
	879.2		Bottom of Hole - 21 feet. Water observed at 14 feet with 14 1/2 feet of hollow-stem auger in the ground. Water observed at 14 feet with 19 1/2 feet of hollow-stem auger in the ground. Water observed at 14 1/2 feet with a cave-in depth of 16 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled with bentonite grout.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		B-4		896.6 (Surveyed)	
Location Co. Coordinate: X=502424 Y=153370 (ft.)				Drill Machine 7514				SHEET 1 of 1	
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/9/11	
No Station-Offset Information Available									
DEPTH	Depth Elev.	Lithology	Classification	Drilling Operation	SPT N ₆₀ REC (%)	MC (%) RQD (%)	COH (psf) ACL (ft)	γ (pcf) Core Breaks	Soil Rock Other Tests Or Remarks Formation or Member
0.7	895.9		8 1/2 inches Bituminous.			7			P200=22% See Grain Size Accumulation Curve.
5			SANDY LOAM, non plastic, trace Gravel to with Gravel, with occasional Clay seams, brown and dark brown, moist. (Fill)	21					
				23					
7.0	889.6			18					
10				16*					*No sample recovery.
				19					
15			SAND, fine to coarse grained, with Gravel, with possible Boulders, brown, moist to 12 feet then waterbearing, medium dense to dense. (Glacial Outwash)	32					
				16					
20				22					
21.0	875.6		Bottom of Hole - 21 feet. Water observed at 12 feet with 12 feet of hollow-stem auger in the ground. Water observed at 15 feet with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 7 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled.						

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-5		897.5 (Surveyed)		
Location				Co. Coordinate: X=502601 Y=153347 (ft.)		Drill Machine 7514		SHEET 1 of 1		
				Latitude (North)= Longitude (West)=		Hammer CME Automatic Calibrated		Drilling Completed 5/18/11		
				No Station-Offset Information Available						
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.0 896.5		12 inches Bituminous.							
	4.0 893.5		LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, brown, moist. (Fill)		18					
	5.0 893.5				26					
	10.0 887.5		SANDY LOAM, non plastic to plastic, with Clay seams and Gravel, brown and dark brown, moist. (Fill)		11	11				
	12.0 885.5		PEAT, well decomposed, black, wet. (Swamp Deposit)		8	21				
	15.0 876.5				TW*					*Thinwall encountered sand. No recovery.
	21.0 876.5		SAND, fine to coarse grained, with Gravel and possible Boulders, with occasional Sandy Loam seams, brown, moist to waterbearing, loose to medium dense. (Glacial Outwash)		10					
					13					
					12					
					16					
Bottom of Hole - 21 feet. Water observed at 16 feet with 19 1/2 feet of hollow-stem auger in the ground. Water observed at 14 feet immediately after withdrawal of auger. Boring immediately backfilled.										
Index Sheet Code 3.0					Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ					

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-6		890.7 (Surveyed)		
Location Co. Coordinate: X=503450 Y=153060 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/9/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC (%)	RQD (%)	ACL (ft)	Core Breaks	Rock	Formation or Member
	0.7		8 inches Bituminous.							
	890.0		8 inches Aggregate Base.							
	1.4									
	889.3									
			SANDY LOAM, non plastic, with Gravel, black and dark brown, moist to waterbearing. (Fill)		8	7				
	5				6*					*Foreign odor in samples.
	7.0									
	883.7		PEAT, fibrous, dark brown, wet. (Swamp Deposit)		3*					
	9.0									
	881.7		CLAY, trace fibers, gray, wet, firm. (Alluvium)		6*					qp=1/2 tsf
	11.0									
	879.7									
					13*					
	15				15*					
			SAND, fine to coarse grained, with Gravel, dark gray to black, waterbearing, medium to dense. (Glacial Outwash)		17*					
	20				20*					
	21.0									
	869.7		Bottom of Hole - 21 feet. Water observed at 5 1/2 feet with 19 feet of hollow-stem auger in the ground. Water observed at 4 feet immediately after withdrawal of auger. Boring immediately backfilled.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation			
				TH 7 & Louisiana Ave Design		B-7		892.8 (Surveyed)			
Location Co. Coordinate: X=504204 Y=153742 (ft.)				Drill Machine 7514				SHEET 1 of 1			
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/9/11			
No Station-Offset Information Available											
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests	
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks	
					REC	RQD	ACL	Core	Rock	Formation	
					(%)	(%)	(ft)	Breaks		or Member	
	2.0	[Cross-hatched pattern]	SILTY CLAY LOAM, trace Gravel, dark brown, wet. (Fill)	[Sawtooth pattern]							
	890.8										
	5.0	[Cross-hatched pattern]	CLAY, with Sand seams, trace Gravel, brown, wet. (Fill)	[Sawtooth pattern]	11	18					
	887.8										
	5	[Dotted pattern]	SAND, fine to coarse grained, trace Gravel to with Gravel, brown, moist to 10 feet then waterbearing, loose to medium dense. (Glacial Outwash)	[Sawtooth pattern]	9						
					15						
					8						
					13						
					21						
					18						
					20						
	21.0										
	871.8										
<p>Bottom of Hole - 21 feet.</p> <p>Water observed at 10 1/2 feet with 19 1/2 feet of hollow-stem auger in the ground.</p> <p>Water not observed to cave-in depth of 9 feet immediately after withdrawal of auger.</p> <p>Boring immediately backfilled.</p>											
Index Sheet Code 3.0					Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11						
					N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ						

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-8		901.1 (Surveyed)		
Location Co. Coordinate: X=504272 Y=153615 (ft.)				Drill Machine 7513				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/20/11		
No Station-Offset Information Available										
DEPTH	Depth Elev.	Lithology	Classification	Drilling Operation	SPT N ₆₀ REC (%)	MC (%) RQD (%)	COH (psf) ACL (ft)	γ (pcf) Core Breaks	Soil Rock	Other Tests Or Remarks Formation or Member
	1.2 899.9		14 inches Bituminous.							
	2.0 899.1		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
			LOAMY SAND, fine to coarse grained, with Gravel, brown and dark brown, moist. (Fill)		55	5				P200=14% See Grain Size Accumulation Curve.
	5.0 896.1				38					
			SANDY LOAM, slightly plastic to plastic, with Gravel, brown, moist to wet. (Fill)		12					
					50*1/2"					*Little sample recovery.
	12.0 889.1				12	22				
			CLAY, trace Gravel, brown, dark brown and black, wet. (Fill)							
	14.5 886.6				TW*					*No thinwall sample recovery.
			SAND, fine to coarse grained, trace Gravel, brown, waterbearing. (Possible Fill)		8					
					8					
	21.0 880.1		Bottom of Hole - 21 feet. Water observed at 17 feet with 19 feet of hollow-stem auger in the ground. Boring immediately backfilled with bentonite grout.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-9		904.8 (Surveyed)		
Location Co. Coordinate: X=504471 Y=153702 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/16/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.3		15 1/2 inches Bituminous.							
	903.5		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
	2.0									
	902.8									
					22	6				P200=14% See Grain Size Accumulation Curve.
5			LOAMY SAND, fine to coarse grained, with Gravel, dark brown, brown and black, moist. (Fill)		18					
	7.0									
	897.8		CLAY, slightly organic, black and gray, wet. (Fill)		8	24				OC = 4%
	9.0									
	895.8									
10			LOAMY SAND, fine to coarse grained, with Gravel, brown and dark brown, moist. (Fill)		15					
	12.0									
	892.8		SANDY LOAM, non plastic, with Gravel and cinders, dark brown and black, moist. (Fill)		12					
	14.0									
	890.8									
15					18					
			SAND, fine to coarse grained, with Gravel, brown, moist, loose to medium dense. (Glacial Outwash)		7					
20										
	21.0				9					
	883.8									
Bottom of Hole - 21 feet. Water not observed with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 17 feet immediately after withdrawal of auger. Boring immediately backfilled.										
Index Sheet Code 3.0					Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ					

BRAUN
INTERTEC



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-10		904.1 (Surveyed)		
Location Co. Coordinate: X=504679 Y=153644 (ft.)				Drill Machine 7513				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/20/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Rock
					REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	1.2		14 inches Bituminous.							
	902.9		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
	2.0									
	902.1		SANDY LOAM, non plastic, with Gravel, trace bituminous fragments, dark brown, moist. (Fill)		50/6"					
	4.0									
5	900.1		LOAMY SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)		24					
	7.0									
	897.1		SANDY LOAM, non plastic, trace Gravel, with Clay seams, brown and dark brown, moist. (Fill)		31					
	9.0									
10	895.1		CLAY, with Loamy Sand seams, trace Gravel, brown and dark brown, wet. (Fill)		10	19				
	12.0									
	892.1		SILTY CLAY, slightly organic to organic, black and gray, wet. (Fill)		10	13				
15										
	16.0				9	23				
	888.1				TW*					*No thinwall sample recovery.
					29					
20										
	21.0		LOAMY SAND, fine to coarse grained, with Gravel, with Sandy Clay Loam seams, brown with gray and black, moist to waterbearing. (Fill)		10					
	883.1		Bottom of Hole - 21 feet. Water observed at 18 feet with 17 feet of hollow-stem auger in the ground. Water observed at 19 feet with 19 feet of hollow-stem auger in the ground. Boring immediately backfilled with bentonite grout.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-11		911.7 (Surveyed)		
Location				Co. Coordinate: X=504841 Y=153782 (ft.)		Drill Machine 7514		SHEET 1 of 1		
				Latitude (North)= Longitude (West)=		Hammer CME Automatic Calibrated		Drilling Completed 5/13/11		
				No Station-Offset Information Available						
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Rock
	0.3 911.4		4 inches Concrete.							
	4.0 907.7		LOAMY SAND, fine to coarse grained, with Gravel, with occasional Clay seams, brown and dark brown, moist. (Fill)		31	5				P200=14% See Grain Size Accumulation Curve.
5					15					
					13					
10					11					
			SAND, fine to coarse grained, trace Gravel to with Gravel, light brown, moist, medium dense. (Glacial Outwash)		16					
15					13					
					14					
20					15					
	21.0 890.7									
Bottom of Hole - 21 feet. Water not observed with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 16 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-12		907.2 (Surveyed)		
Location Co. Coordinate: X=504873 Y=153696 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/16/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.6		19 inches Bituminous.							
	905.6									
	5.0		SAND, fine to coarse grained, with Gravel, dark brown and brown, dry to moist. (Fill)		42	4				P200=5% See Grain Size Accumulation Curve.
	902.2				34					
	9.0		SAND, fine to coarse grained, with Gravel and possible Boulders, brown and light brown, moist. (Fill)		50*/1"					*No sample recovery.
	898.2									
	10				6					
					10					
	15		SAND, fine to coarse grained, trace Gravel to with Gravel, light brown, moist, loose to medium dense. (Glacial Outwash)		14					
					17					
	20				15					
	21.0									
	886.2		Bottom of Hole - 21 feet. Water not observed with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 16 feet immediately after withdrawal of auger. Boring immediately backfilled.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-13		906.8 (Surveyed)		
Location Co. Coordinate: X=505080 Y=153615 (ft.)				Drill Machine 7513				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/20/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.5 905.3		18 inches Bituminous.							
5			SANDY LOAM, non plastic, with Gravel, brown, moist. (Fill)		50/6"	3				P200=21% See Grain Size Accumulation Curve.
	7.0 899.8				23					
					22					
10					26					
					24					
			SAND, fine to coarse grained, with Gravel, brown to light brown, wet, medium dense to dense. (Glacial Outwash)		27					
15					14					
					44					
20										
	21.0 885.8									
<p>Bottom of Hole - 21 feet. Water not observed with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 12 feet immediately after withdrawal of auger. Boring immediately backfilled.</p>										
<p>Index Sheet Code 3.0</p>										
<p>Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ</p>										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		B-14		907.9 (Surveyed)		
Location Co. Coordinate: X=505274 Y=153641 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/16/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation or Member
					(%)	(%)	(ft)	Breaks		
	1.0		12 inches Bituminous.							
	906.9									
	2.5		LOAMY SAND, fine to coarse grained, with Gravel, dark brown and brown, moist. (Fill)							
	905.4									
5					22	3				P200=5% See Grain Size Accumulation Curve.
					16					
					18					
10					26					
			SAND, fine to coarse grained, with Gravel, light brown, moist, medium dense to dense. (Glacial Outwash)		25					
					22					
15					24					
			With Sandy Loam seams from 17 to 20 feet.		21					
20										
	21.0									
	886.9									
Bottom of Hole - 21 feet. Water not observed with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 15 feet immediately after withdrawal of auger. Boring immediately backfilled.										
Index Sheet Code 3.0 Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		E-1		896.5 (Surveyed)		
Location Co. Coordinate: X=502805 Y=153394 (ft.)				Drill Machine 7514				SHEET 1 of 2		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.0 895.5		11 1/2 inches Bituminous.							
	2.0 894.5		SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)			4				
			SANDY LOAM, non plastic, trace Gravel, dark brown and black, moist. (Fill)		15	7				
	5.0 891.5		LOAMY SAND, fine to coarse grained, trace Gravel, with Sandy Loam layers, brown, moist. (Fill)		21	4				
			PEAT, semi fibrous, black to dark brown, wet. (Swamp Deposit)		8	8				
	9.0 887.5				8	241				
			CLAY, brown, wet. (Swamp Deposit/Alluvium)		TW*					*No thinwall sample recovery.
	15.0 881.5				TW	16	237	113		
	17.0 879.5				18	13				
			SAND, fine to coarse grained, with Gravel, with occasional Sandy Loam seams, brown to gray, waterbearing, medium dense. (Glacial Outwash)		18	18				
					12	19				
	25									

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 2

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		E-1		896.5 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	27.0 869.5		SAND, fine to coarse grained, with Gravel, with occasional Sandy Loam seams, brown to gray, waterbearing, medium dense. (Glacial Outwash) (continued)		18	12			
30					16	13			P200=5% See Grain Size Accumulation Curve.
			GRAVEL, with Sand, brown, waterbearing, loose. (Glacial Outwash)		14	10			
					8	13			P200=2% See Grain Size Accumulation Curve.
35					10*				*No sample recovery.
	37.0 859.5		SAND, fine to coarse grained, with Gravel, brown, waterbearing, loose to medium dense. (Glacial Outwash)		9	11			
40					11	12			
	41.0 855.5		Bottom of Hole - 41 feet. Water observed at 17 feet with 17 feet of hollow-stem auger in the ground. Water observed at 18 feet with 39 feet of hollow-stem auger in the ground. Boring immediately backfilled with bentonite grout.						

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		E-2		896.6 (Surveyed)		
Location				Co. Coordinate: X=503000 Y=153370 (ft.)		Drill Machine 7514		SHEET 1 of 2		
				Latitude (North)= Longitude (West)=		Hammer CME Automatic Calibrated		Drilling Completed 5/18/11		
				No Station-Offset Information Available						
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	0.9		11 inches Bituminous.							
	895.7		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)			3				
	2.0									
	894.6				38	5				
5			LOAMY SAND, fine to coarse grained, with Gravel, dark brown, moist. (Fill)							
					34	5				
					35	6				
	9.0									
	887.6		CLAY, slightly organic, with Sandy Loam seams, black and gray, wet. (Fill)		4	17				LL=31, PI=14
10										
	12.0									
	884.6		SANDY LOAM, slightly plastic, trace Gravel, dark brown, moist. (Fill)		16	14				
	14.0									
	882.6				9	18				
15			LOAMY SAND, fine to coarse grained, trace Gravel, dark brown, waterbearing. (Fill)							
					11	47				
	20.0									
	876.6				TW	48	484	72		See Unconfined Compression and U-U Test Reports.
			SILTY CLAY LOAM, organic, black, wet. (Swamp Deposit)		2	49				LL=47, PI=13
25										

Index Sheet Code 3.0



















(Continued Next Page)

Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

BRAUN
INTERTEC



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		E-2		896.6 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	Y	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
					(%)	(%)	(ft)			
	26.0 870.6		SILTY CLAY LOAM, organic, black, wet. (Swamp Deposit) (continued)							
			SANDY LOAM, plastic, trace Gravel, brown, wet, firm. (Alluvium)		7*	13				*Foreign odor in samples.
30					8*	13				
	31.0 865.6				9	15				
					9	15				
35					11	15				
					12	13				
40										
	41.0 855.6									
Bottom of Hole - 41 feet. Water observed at 13 feet with 14 1/2 feet of hollow-stem auger in the ground. Water observed at 14 feet with 39 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 11 feet immediately after withdrawal of auger. Boring immediately backfilled with bentonite grout.										
Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ										

BRAUN
INTERTEC



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation			
				TH 7 & Louisiana Ave Design		E-3		896.6 (Surveyed)			
Location				Co. Coordinate: X=503182 Y=153474 (ft.)		Drill Machine 7514			SHEET 1 of 2		
				Latitude (North)= Longitude (West)=		Hammer CME Automatic Calibrated			Drilling Completed 5/17/11		
				No Station-Offset Information Available							
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests Or Remarks	
	Elev.				N60	(%)	(psf)	(pcf)			Rock
					REC	RQD	ACL	Core Breaks		Formation or Member	
					(%)	(%)	(ft)				
	1.0		11 1/2 inches Bituminous.								
	895.6		SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)								
	2.0										
	894.6										
					22	6				P200=17% See Grain Size Accumulation Curve.	
5			LOAMY SAND, fine to coarse grained, with Gravel, with Loamy Sand layers, dark brown, moist. (Fill)								
					13	4					
	7.0										
	889.6				12*	8				*Foreign odor noted in samples from 7 1/2 feet and below.	
			SAND, fine to coarse grained, with Gravel, brown, moist to waterbearing. (Fill)								
10					13	11					
	12.0										
	884.6				4	13					
			LOAMY SAND, fine to coarse grained, with Gravel, brown, waterbearing. (Fill)								
15					5	11					
	17.0										
	879.6				4	13					
			SAND, fine to coarse grained, with Gravel, non to slightly organic, gray to black, waterbearing. (Fill)								
	19.0										
	877.6				8	25					
20											
			CLAY, slightly organic to organic, with Sand seams, trace fibers and roots, black to gray, wet. (Swamp Deposit)								
					TW	23	1051	106		See Unconfined Compression and U-U Test Reports.	
25											

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 2

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		E-3		896.6 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
			CLAY, slightly organic to organic, with Sand seams, trace fibers and roots, black to gray, wet. (Swamp Deposit) (continued)		12	22			LL = 33, PI = 14
	29.0 867.6				TW	27	257	98	Cc=0.11, Cr=0.02 See Consolidation Test Report.
30			SAND, fine to coarse grained, trace Gravel to with Gravel, gray, waterbearing, medium dense. (Glacial Outwash)		13	15			
	34.0 862.6				9	11			LL=18, PI=5
35			SILTY CLAY, with Sand seams, trace Gravel, gray, wet, stiff. (Glacial Till)		12	12			
	39.0 857.6				13	12			
40			SANDY LOAM, plastic, trace Gravel, with Sand seams, gray, waterbearing, stiff. (Glacial Till)		10	12			
	41.0 855.6								

Bottom of Hole - 41 feet.
Water observed at 12 feet with 19 1/2 feet of hollow-stem auger in the ground.
Water observed at 15 1/2 feet with 39 1/2 feet of hollow-stem auger in the ground.
Boring immediately backfilled with bentonite grout.

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		E-4		893.1 (Surveyed)		
Location Co. Coordinate: X=503401 Y=153396 (ft.)				Drill Machine 7506				SHEET 1 of 2		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 6/6/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	0.8 892.3		LOAMY SAND, fine to coarse grained, dark brown, moist. (Topsoil Fill)				14			
	4.0 889.1		SANDY LOAM, non plastic, with Gravel and wood fragments, brown, gray and black, moist. (Fill)		8	15				
	5.0 886.1		SAND, fine to coarse grained, with Gravel, gray, moist. (Fill)		7	3				
	7.0 886.1				5	13				
	10.0 881.1		LOAMY SAND, fine to coarse grained, trace Gravel, dark brown, waterbearing. (Fill)		2*	15				*Switched to mud rotary drilling after 10-foot sample.
	12.0 881.1				4	18				
	15.0 874.1		GRAVEL, gray, waterbearing. (Fill)		8*	19				*Foreign odor in sample. P200=2% See Grain Size Accumulation Curve.
	19.0 874.1				5*	21				*Foreign odor in sample.
	20.0 874.1				9*	14				*Foreign odor in sample.
	25.0		SAND, fine to coarse grained, with Gravel, dark brown, waterbearing. (Fill)		NA*					*Obstruction encountered in hollow stem auger.

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 2

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		E-4		893.1 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	27.0 866.1		SAND, fine to coarse grained, with Gravel, dark brown, waterbearing. (Fill) (continued)		11*				*No sample recovery. Coarse sand and gravel in cuttings.
	29.5 863.6		PEAT, spongy, trace shells, dark brown to olive, wet. (Swamp Deposit)		9	185			LL=264, PI=173
30					TW*				*No thinwall sample recovery.
	35.0 858.1		SAND, fine to coarse grained, with Gravel, dark gray, waterbearing, medium dense. (Glacial Outwash)		13*	11			*Foreign odor in sample.
35					23*	22			*Foreign odor in sample.
	41.0 852.1		GRAVEL, gray, waterbearing, medium dense to dense. (Glacial Outwash)		26*	18			*Foreign odor in sample. P200=5% See Grain Size Accumulation Curve.
40					16	13			
Bottom of Hole - 41 feet. Water observed at 7 feet with 7 feet of hollow-stem auger in the ground. Boring immediately backfilled with bentonite grout.									

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		E-5		898.9 (Surveyed)		
Location Co. Coordinate: X=503882 Y=153542 (ft.)				Drill Machine 7514				SHEET 1 of 2		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	0.9		11 inches Bituminous.							
	898.0		LOAMY SAND, fine to medium grained, trace Gravel, brown, moist. (Fill)			4				
	2.0									
	896.9		LOAMY SAND, fine to coarse grained, with Gravel, brown and dark brown, moist. (Fill)		42	9				
	4.0									
	894.9									
	5				32	7				
			SANDY LOAM, slightly plastic, with Gravel, with occasional Clay seams, dark brown and brown, moist. (Fill)		23	7				
	10				28	6				
					11	7				
	12.0									
	886.9				5	14				
	15									
					4	15				
			SAND, fine to coarse grained, trace to with Gravel, brown, moist to waterbearing. (Fill)							
	20		With trace black Clay at 20 feet.		2	18				
					10	14				
	25		With gray Clay seam at 25 feet.							

P200=9%
See Grain Size
Accumulation Curve.

Index Sheet Code 3.0

(Continued Next Page)



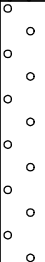



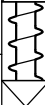
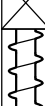


Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

BRAUN
INTERTEC



U.S. Customary Units

Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS							SHEET 2 of 2			
State Project		Bridge No. or Job Desc.		Trunk Highway/Location			Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design			E-5		898.9 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Rock
					REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	27.0 871.9		SAND, fine to coarse grained, trace to with Gravel, brown, moist to waterbearing. (Fill) (continued)		18	12				P200=1% See Grain Size Accumulation Curve.
30			GRAVEL, gray, waterbearing, dense. (Glacial Outwash)		34	5				
					18	18				
	32.0 866.9		SAND, fine to coarse grained, with Gravel, with possible Boulders, gray, waterbearing, medium dense to dense. (Glacial Outwash)		32	18				
35					12	17				
					15	10				
40					18	11				
	41.0 857.9		<p>Bottom of Hole - 41 feet.</p> <p>Water observed at 14 feet with 14 1/2 feet of hollow-stem auger in the ground.</p> <p>Water observed at 8 1/2 feet with 39 1/2 feet of hollow-stem auger in the ground.</p> <p>Water observed at 8 feet with a cave-in depth of 16 feet immediately after withdrawal of auger.</p> <p>Boring immediately backfilled with bentonite grout.</p>							
<div>Soil Class: J. Van Abel Rock Class: Edit: Date: 9/26/11 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ</div>										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		P-1		888.0 (Surveyed)		
Location Co. Coordinate: X=503670 Y=153708 (ft.)				Drill Machine 7506				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 6/6/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core		Formation
					(%)	(%)	(ft)	Breaks	Rock	or Member
	0.3 887.7		Loamy Sand, fine to coarse grained, trace roots and Gravel, black and brown, moist. (Topsoil Fill)							
	5									
			PEAT, fibrous to semi fibrous, dark brown, wet. (Swamp Deposit)		2					
	7.0 881.0									
			LOAMY SAND, fine to coarse grained, trace Gravel, gray, wet, loose. (Alluvium)		8					
	10.0 878.0									
			LOAM, trace fibers, with Sand seams, gray, wet, soft. (Alluvium)		4					
	12.0 876.0									
	15									
			SAND, fine to coarse grained, with Gravel, gray, waterbearing, medium dense. (Glacial Outwash)		14					
	16.0 872.0				15					
Bottom of Hole - 16 feet. Water observed at 7 feet with 7 feet of hollow-stem auger in the ground. Water not observed with 14 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 9 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-1		893.9 (Surveyed)		
Location Co. Coordinate: X=502895 Y=153317 (ft.)				Drill Machine 7514				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 6/8/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
					(%)	(%)	(ft)			
	2.0		SANDY LOAM, non plastic, with Gravel, trace roots, dark brown, moist. (Fill)							Note: Laboratory tests not performed on all samples due to potential contamination.
	891.9									
	4.0		SANDY LOAM, plastic, trace Gravel, dark brown, moist. (Fill)		6					
	889.9									
5			LOAMY SAND, fine to coarse grained, trace Gravel, with Clay lenses, dark brown and brown, moist. (Fill)		4					
	7.0									
	886.9									*Foreign odor in samples.
	9.0		SANDY LOAM, plastic, trace Gravel, black, wet. (Fill)		7*					
	884.9									
10					15*					
			SANDY LOAM, non plastic, trace Gravel, black and brown, waterbearing. (Fill)							
	14.0				14*	13				
	879.9									
15					15*					
			LOAMY SAND, fine to coarse grained, with Gravel, with occasional Sandy Loam seams, brown and black, waterbearing. (Possible Fill)		8*					
					10*					
20										
	22.0				16*					
	871.9									
			SAND, fine to coarse grained, trace Gravel to with Gravel, with possible Boulders, brown, waterbearing, loose to very dense. (Glacial Outwash)							
25										

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

BRAUN
INTERTEC



U.S. Customary Units

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-1		893.9 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N60	(%)	(psf)	(pcf)		Rock
					REC	RQD	ACL	Core		Formation
					(%)	(%)	(ft)	Breaks		or Member
			SAND, fine to coarse grained, trace Gravel to with Gravel, with possible Boulders, brown, waterbearing, loose to very dense. (Glacial Outwash) (continued)		20	11				
55	54.0 839.9		CLAY, with frequent Sand seams and lenses, gray and brown, wet, very stiff. (Glacial Till)		35	21				LL=24, PI=15
	57.0 836.9		SANDY LOAM, non plastic, brown, waterbearing, dense. (Glacial Outwash)		31	24				P200=31% See Grain Size Accumulation Curve.
60	62.0 831.9		SAND, fine to coarse grained, with Gravel and possible Boulders, brown, waterbearing, dense to very dense. (Glacial Outwash)		23	37				
65					50/5"	20				
70										Auger refusal at 73 feet, switched to rock coring.
	73.0 820.9		LIMESTONE, slightly weathered, with vugs from 73 to 74 feet, hard, crinkly bedded, intensely to highly fractured, dark gray to gray.					6		Apparent Top of Bedrock
								6		PLATTEVILLE FORMATION
75										

(Continued Next Page)

Soil Class:J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\WINNEAPOLIS\2009\00745A-MNDOT.GPJ

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-1		893.9 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Rock
80	76.0		LIMESTONE, slightly weathered, with vugs from 73 to 74 feet, hard, crinkly bedded, highly to moderately fractured, gray.		100	42	0.53	5	PLATTEVILLE FORMATION	
	817.9							3		
								2		
								2		
								1		
					100	90	1.13	0		
								2		
								0		
	83.0		END OF CORING. Water observed at 9 feet while drilling. Boring immediately backfilled with bentonite grout.							
	810.9									

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN
INTERTEC**UNIQUE NUMBER**

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-2		892.9 (Surveyed)		
Location Co. Coordinate: X=503106 Y=153493 (ft.)				Drill Machine 7514				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 6/3/11		
No Station-Offset Information Available										
DEPTH	Depth Elev.	Lithology	Classification	Drilling Operation	SPT N ₆₀ REC (%)	MC (%) RQD (%)	COH (psf) ACL (ft)	γ (pcf) Core Breaks	Soil Rock	Other Tests Or Remarks Formation or Member
1.0	891.9		SANDY LOAM, slightly plastic, with roots, dark brown, moist. (Fill)			7				Note: Laboratory tests not performed on all samples due to potential contamination. P200=14% See Grain Size Accumulation Curve.
5			LOAMY SAND, fine to coarse grained, with Gravel, dark brown and brown, moist. (Fill)		30					
7.0	885.9				15	10				
10					4	81				
					TW	47	689	69		See U-U Test Report.
15			PEAT, semi fibrous, black to dark brown, wet. (Swamp Deposit)		4*					*Foreign odor in samples.
					TW*	225	527	22		See Unconfined Compression Report.
17.0	875.9				7*					
20			SILT, organic, gray and black, wet. (Swamp Deposit)							
21.0	871.9				TW*	20	339	109		See Unconfined Compression Report.
					11*	12				
25			LOAMY SAND, fine to coarse grained, trace Gravel, brown with black, waterbearing, loose to medium dense. (Alluvium/Glacial Outwash)							

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-2		892.9 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	29.0 863.9		LOAMY SAND, fine to coarse grained, trace Gravel, brown with black, waterbearing, loose to medium dense. (Alluvium/Glacial Outwash) (continued)		16*	12				
					8*	18				
30					4	23				
					9	20				
					9	20				
35					11	16				
					14	19				
40			SAND, fine to coarse grained, trace Gravel to with Gravel, brown, waterbearing, very loose to medium dense. (Glacial Outwash)		15					
					16					
45					17					
50										

P200=1%
See Grain Size
Accumulation Curve.

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location TH 7 & Louisiana Ave Design		Boring No. R-2		Ground Elevation 892.9 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	
55			SAND, fine to coarse grained, trace Gravel to with Gravel, brown, waterbearing, very loose to medium dense. (Glacial Outwash) (continued)		20				P200=6% See Grain Size Accumulation Curve.
					7				
60					15	16			
65					19				P200=7% See Grain Size Accumulation Curve.
					52	19			
70	69.0 823.9		SAND, fine to coarse grained, brown, waterbearing, very dense. (Glacial Outwash)						
75	74.0 818.9 75.0		SANDY LOAM, slightly plastic, with Gravel, Limestone and Shale fragments, brown and gray, waterbearing, very		50*1/2"				*Switched to rock coring after sample.

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location			Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design			R-2		892.9 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Soil Rock	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	817.9		dense. (Glacial Till)							
			LIMESTONE, slightly weathered, hard, crinkly bedded, highly fractured, gray.		100	55	0.91	4		Apparent Top of Bedrock
	78.0							2		
	814.9							5		PLATTEVILLE FORMATION
								0		
80								1		
			LIMESTONE, slightly weathered, hard, crinkly bedded, moderately to slightly fractured, gray.		100	98	1.22	0		PLATTEVILLE FORMATION
								1		
								2		
								0		
								1		
85	85.0		END OF CORING.							
	807.9		Water observed at 21 feet while drilling. Boring immediately backfilled with bentonite grout.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-3		892.0 (Surveyed)		
Location Co. Coordinate: X=503197 Y=153358 (ft.)				Drill Machine 7514				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 6/8/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
					(%)	(%)	(ft)			
	2.0		SANDY LOAM, slightly plastic, trace Gravel, black and brown, moist. (Topsoil Fill)							Note: Laboratory tests not performed on all samples due to potential contamination.
	890.0									
	4.0		SILT LOAM, trace Gravel, black, moist. (Fill)		4	65				
	888.0									
5			LOAMY SAND, fine to coarse grained, trace Gravel, roots and wood, black and brown, waterbearing. (Fill)		6	22				OC=2%
	7.0									
	885.0		PEAT, fibrous, dark brown, wet. (Swamp Deposit)		4	428				
	9.0									
	883.0									
10			PEAT, well decomposed, trace shells, brown and dark brown, wet. (Swamp Deposit)		TW	359	639	14		See Unconfined Compression and U-U Test Reports.
	15.5				4	161				
	876.5				TW	179	224	26		See Unconfined Compression Report.
			SILTY CLAY LOAM, trace fibers, black to light gray, wet. (Swamp Deposit/Alluvium)		3*	55				*Foreign odor in samples.
	20				TW*	84	226	50		See Unconfined Compression Report.
	22.0				4*					
	870.0		LOAMY SAND, fine to coarse grained, with Gravel, dark brown, waterbearing, very loose to loose. (Alluvium/Glacial Outwash)							
25										

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-3		892.0 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	27.0 865.0		LOAMY SAND, fine to coarse grained, with Gravel, dark brown, waterbearing, very loose to loose. (Alluvium/Glacial Outwash) (continued)		7*					
30					6*	20				
					4*	18				
					5	16				
35					7	17				
					13	15				
40			SAND, fine to coarse grained, trace Gravel to with Gravel, brown, waterbearing, very loose to medium dense. (Glacial Outwash)		14	19				
					12	13				
45					11	13				
					13	14				
50										

P200=1%
See Grain Size
Accumulation Curve.

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-3		892.0 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
55	55.0 837.0	SAND, fine to coarse grained, trace Gravel to with Gravel, brown, waterbearing, very loose to medium dense. (Glacial Outwash) (continued)			16	16			P200=6% See Grain Size Accumulation Curve.
		SAND, fine to coarse grained, with Gravel and possible Boulders, brown, waterbearing, dense. (Glacial Outwash)			31*	18			*Little sample recovery.
60		SAND, fine to coarse grained, with Gravel and possible Boulders, brown, waterbearing, dense. (Glacial Outwash)			38*	17			*Little sample recovery.
65		SAND, fine to coarse grained, with Gravel and possible Boulders, brown, waterbearing, dense. (Glacial Outwash)			35	19			
70	70.0 822.0	With Shale seam at 71 feet. LIMESTONE, slightly weathered, hard, crinkly bedded, intensely to highly fractured, dark gray to gray.			100	20	0.50		Auger refusal at 70 feet, switched to rock coring.
								6	Apparent Top of Bedrock PLATTEVILLE FORMATION
								4	
								6	
								6	
75	75.0							5	

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location			Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design			R-3		892.0 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Soil Rock	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	817.0		LIMESTONE, slightly weathered, hard, crinkly bedded, highly to moderately fractured, brown and gray. With Shale seam at 77 feet.		100	90	1.13	0	PLATTEVILLE FORMATION	
								1		
								4		
								0		
								2		
80	80.0		END OF CORING. Water observed at 4 feet while drilling. Boring immediately backfilled with bentonite grout.							
	812.0									

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN
INTERTEC**UNIQUE NUMBER**

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-4		895.3 (Surveyed)		
Location Co. Coordinate: X=503440 Y=153402 (ft.)				Drill Machine 7514				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/25/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
					(%)	(%)	(ft)			
	2.0		SANDY LOAM, plastic, slightly organic, black, moist. (Fill)			17				
	893.3									
	5		SANDY CLAY LOAM, with slightly organic layers, trace Gravel and roots, brown, dark brown and black, moist to wet. (Fill)		5	13				
					6	26				
	7.5				4	21				
	887.8				8	14				
	10				2*	18				*Foreign odor in sample.
	15		LOAMY SAND, fine to coarse grained, with Gravel, brown to dark brown, waterbearing. (Fill) With Clay layer at 15 feet.		4	19				
					7	9				
	20				11*	17				*Foreign odor in sample.
	22.0				10	17				
	873.3		SAND, fine to coarse grained, trace Gravel, dark brown, waterbearing. (Fill)							
	25									

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-4		895.3 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	27.0 868.3		SAND, fine to coarse grained, trace Gravel, dark brown, waterbearing. (Fill) (continued)		11	20			Note: Switched to 3" casing at 25 feet. No thinwalls were taken due to use of casing for borehole advancement.
	30.0 865.3		PEAT, spongy, trace shells, organic, dark brown, wet. (Swamp Deposit)		14	104			
30	34.0 861.3		SILTY CLAY LOAM, organic, olive to gray, wet. (Swamp Deposit/Alluvium)		9	79	313	52	See Unconfined Compression and U-U Test Reports.
					11	22			qp=1 tsf LL=40, PI=21
35			GRAVEL, with Sand and possible Boulders, brown to dark brown, waterbearing, medium dense to dense. (Glacial Outwash)		25	12			P200=5% See Grain Size Accumulation Curve.
					18*	14			*Foreign odor in sample.
40	40.0 855.3		SANDY LOAM, plastic, with Gravel, gray, wet, very stiff. (Glacial Till)		18	12			
					20	13			
45	44.0 851.3		SAND, fine to coarse grained, with Gravel, with possible Boulders, brown, waterbearing, medium dense. (Glacial Outwash)		16	14			
					12	12			
50									

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-4		895.3 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation or Member
					(%)	(%)	(ft)	Breaks		
55		SAND, fine to coarse grained, with Gravel, with possible Boulders, brown, waterbearing, medium dense. (Glacial Outwash) (continued)		X	24	13				P200=2% See Grain Size Accumulation Curve.
				X	22	17				
60				X	15	33				
65				X	100*/1"	32				
70	69.0 826.3	SAND, fine to coarse grained, brown, moist, dense. (Glacial Outwash)		X	28	17				P200=3% See Grain Size Accumulation Curve.
75	75.0									
Auger refusal at 75 feet, switched to coring.										

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location			Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design			R-4		895.3 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Soil Rock	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	820.3							3		Apparent Top of Bedrock
								2		
			With Shale seam at 77 1/2 feet.		100	77	0.77	3		
								1		
80			LIMESTONE, slightly weathered, hard, crinkly bedded, generally moderately fractured, gray.					1		PLATTEVILLE FORMATION
								0		
					100	91	1.52	1		
								1		
								1		
85	85.0		END OF CORING.							
	810.3		Water observed at 7 1/2 while drilling. Boring immediately backfilled with bentonite grout.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-5		897.0 (Surveyed)		
Location Co. Coordinate: X=503613 Y=153443 (ft.)				Drill Machine 7514				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/12/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	0.9		10 1/2 inches Bituminous.							
	896.1		LOAMY SAND, fine to medium grained, with Gravel, brown, moist. (Fill)							
	2.0									
	895.0									
5					48	5				
					27	4				
			LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, brown with dark brown, moist. (Fill)							
					24	5				
10					6	9				
	12.0				6	17				
	885.0									
15					7	14				P200=3% See Grain Size Accumulation Curve.
			SAND, fine to coarse grained, trace Gravel to with Gravel, with seam of Clay at 18 feet, brown, moist to waterbearing. (Fill)		7*	12				*Switched to mud rotary drilling from 17 1/2 to 40 feet.
20					8	14				
	22.0				20	20				
	875.0		SAND, fine to coarse grained, with Gravel and possible Boulders, brown, waterbearing. (Fill)							
25										

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-5		897.0 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
					25*				*No sample recovery.
					28	15			
					27	20			
30			SAND, fine to coarse grained, with Gravel and possible Boulders, brown, waterbearing. (Fill) (continued)						
	32.0 865.0		LOAMY SAND, fine to coarse grained, with Clay seams, with Gravel, brown with gray, waterbearing. (Fill)		26	10			
	34.0 863.0		SANDY LOAM, non plastic, trace Gravel, brown, gray and black, wet. (Fill)		30	15			
35									
	37.0 860.0		GRAVEL, brown, waterbearing. (Possible Fill)		35	17			
					27*	21			P200=3% See Grain Size Accumulation Curve.
40			SAND, fine to coarse grained, with Gravel, brown, waterbearing. (Possible Fill)		23	14			*Switched to standard hollow-stem auger drilling after sample.
	42.0 855.0		With lenses of Peat at 45 feet.		21	57			
			SAND, fine to coarse grained, with Gravel, brown, waterbearing, medium dense. (Glacial Outwash)		19	15			
45									
	45.0 852.0								
50									

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-5		897.0 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
			SAND, fine to coarse grained, with Gravel, brown, waterbearing, medium dense. (Glacial Outwash) (continued)		20	21				
55	54.0 843.0									
			GRAVEL, brown, waterbearing, medium dense. (Glacial Outwash)		13	19				P200=3% See Grain Size Accumulation Curve.
60	59.0 838.0									
					11	13				
65										
			SAND, fine to coarse grained, with Gravel, brown, waterbearing, medium dense to dense. (Glacial Outwash)		25	19				
70										
					28	17				
75	74.0 823.0 75.0		LOAMY SAND, fine to coarse grained, with Gravel and Limestone fragments, reddish brown and gray,		50*/1"	12				*Switched to rock coring after sample.

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-5		897.0 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	822.0		waterbearing. (Glacial Till)					3	Apparent Top of Bedrock
					100	84	0.70	4	
								1	
80			LIMESTONE, slightly weathered, hard, with Shale inclusions at 80 to 81 feet, crinkly bedded, gray.					0	PLATTEVILLE FORMATION
					100	82	1.02	6	
								0	
								1	
								3	
								0	

END OF BORING.
Water observed at 13 feet with 19 1/2 feet of hollow-stem auger in the ground.
Boring immediately backfilled with bentonite grout.

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-6		897.0 (Surveyed)		
Location Co. Coordinate: X=503543 Y=153591 (ft.)				Drill Machine 7514				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 6/13/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	0.3 896.7	4 inches Concrete.								
	4.0 893.0	LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, brown to dark brown, moist. (Fill)			21	6				
	5									
	10.0 887.0	SAND, fine to coarse grained, with Gravel, brown, moist to waterbearing. (Fill)			12	6				P200=7% See Grain Size Accumulation Curve.
	12.0 885.0	LOAMY SAND, fine to coarse grained, trace Gravel, with Peat seams, brown with black, waterbearing. (Fill)			9	7				
	15									
	17.0 880.0	LOAMY SAND, fine to coarse grained, trace Gravel, dark brown, waterbearing. (Fill)			5	24				OC=4%
	20.0 877.0	PEAT, partially decomposed, trace shells, black, wet. (Swamp Deposit)			20*	14				*Foreign odor in samples.
	20				20*	25				
		CLAY, trace fibers, with Sand seams, gray, wet. (Alluvium/Swamp Deposit)			8	160				
					TW	144	232	33		See Unconfined Compression Report.
	25				10	27				

Index Sheet Code 3.0

(Continued Next Page)



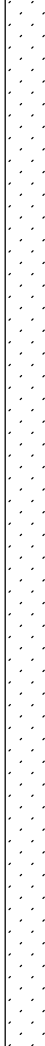

























Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

BRAUN
INTERTEC



SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-6		897.0 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N60	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	27.0		CLAY, trace fibers, with Sand seams, gray, wet. (Alluvium/Swamp Deposit) (continued)		TW	22	592	107		See Unconfined Compression Report.
	870.0									
					15	12				
	30									
					13	13				
										
					12	14				
	35									
					28	11				
										
					20	14				
										
	40				24	16				
										
					19	14				
										
					17	16				
										
	45				14	20				
										
										
	47.0									
	850.0									
										
										
	50									

(Continued Next Page)

Soil Class:J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-6		897.0 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
55			SAND, fine to coarse grained, brown, waterbearing, medium dense. (Glacial Outwash) (continued)		19	24				P200=3% See Grain Size Accumulation Curve.
						24	23			
60						17	20			
						21	26			
65										
69.0	828.0		SANDY LOAM, plastic, with Gravel, with Sand seams, reddish brown, wet, very stiff. (Glacial Till)		23	12				P200=32% See Grain Size Accumulation Curve.
74.0	823.0		WEATHERED SHALE, gray, wet.							
75										Apparent Top of Bedrock

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-6		897.0 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	76.0		WEATHERED SHALE, gray, wet. (continued)		50/2"	13			Switched to rock coring at 76 feet.
	821.0		SHALE, highly weathered, with Gravel and Limestone fragments, gray.					3	
	76.3		LIMESTONE, slightly weathered, hard, crinkly bedded, highly to moderately fractured, gray.		100	68	0.68	1	PLATTEVILLE FORMATION
	820.7							2	
								3	
80								2	
								1	
					100	98	0.82	2	
								1	
								0	
85								2	
	86.0								

END OF CORING.
Water observed at 7 feet while drilling.
Boring immediately backfilled with bentonite grout.

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-7		896.6 (Surveyed)		
Location Co. Coordinate: X=503722 Y=153613 (ft.)				Drill Machine 7514				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 5/10/11		
No Station-Offset Information Available										
DEPTH	Depth Elev.	Lithology	Classification	Drilling Operation	SPT N ₆₀ REC (%)	MC (%) RQD (%)	COH (psf) ACL (ft)	γ (pcf) Core Breaks	Soil Rock	Other Tests Or Remarks Formation or Member
5	7.0 889.6		SANDY LOAM, non to slightly plastic, trace Gravel and wood, dark brown, moist. (Fill)		5	41				
					12	12				
10			SAND, fine to coarse grained, brown, moist to waterbearing. (Fill)		10	3				
					11	6				
15	14.0 882.6		LOAMY SAND, fine to medium grained, brown, waterbearing. (Fill)		6	16				
					2	15				
17.0	879.6		PEAT, dark brown, wet. (Swamp Deposit)		8	106				
19.0	877.6									
20			SILTY CLAY LOAM, slightly organic to organic, trace fibers, gray, wet. (Swamp Deposit)		TW	25	625	100		See Unconfined Compression and U-U Test Reports.
					7	33				LL=38, PI=10
25										

Index Sheet Code 3.0

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11

N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-7		896.6 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	26.0 870.6		SILTY CLAY LOAM, slightly organic to organic, trace fibers, gray, wet. (Swamp Deposit) (continued)		TW	36	195	83	See Unconfined Compression and U-U Test Reports.
30					36	9			
					25	10			P200=3% See Grain Size Accumulation Curve.
					25	14			
35					20	8			P200=0.5% See Grain Size Accumulation Curve.
					18	9			
40	39.0 857.6				26	14			
					18	14			
45					18	18			
					21	15			
50									

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-7		896.6 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
55			SAND, fine to coarse grained, trace Gravel to with Gravel, brown, waterbearing, medium dense to dense. (Glacial Outwash) (continued)		26	14			P200=3% See Grain Size Accumulation Curve.
	59.0 837.6								
60			SANDY LOAM, reddish brown, wet, very stiff. (Glacial Till)		36	20			P200=49% See Grain Size Accumulation Curve.
	64.0 832.6								
65			SAND, fine to coarse grained, with Gravel, brown, waterbearing, medium dense. (Glacial Outwash)		19	17			
	69.0 827.6								
70			LOAMY SAND, fine grained, brown, waterbearing, medium dense. (Glacial Outwash)		26	14			
	72.0 824.6								
	73.0 823.6		LIMESTONE, highly weathered, gray, waterbearing.		100*3"				*Switched to rock coring after sample.
			LIMESTONE, highly weathered, hard, intensely fractured, gray, with Shale inclusion at 75 feet.		75	50	0.60	NA	Apparent Top of Bedrock
								NA	PLATTEVILLE FORMATION
75	75.0								

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location			Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design			R-7		896.6 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Soil Rock	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	821.6		LIMESTONE, slightly weathered, hard, crinkly bedded, intensely to moderately fractured, gray.		75	50	0.60	2	PLATTEVILLE FORMATION	
								1		
								1		
								3		
								0		
80					100	88	1.46	1		
								1		
								1		
	83.0									
	813.6		END OF BORING. Water observed at 12 feet while drilling. Boring immediately backfilled with bentonite grout.							

BRAUN
INTERTEC



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-8		888.0 (Surveyed)		
Location Co. Coordinate: X=503778 Y=153425 (ft.)				Drill Machine 7503				SHEET 1 of 4		
Latitude (North)= Longitude (West)=				Hammer CME Automatic Calibrated				Drilling Completed 6/9/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N60	MC (%)	COH (psf)	γ (pcf)	Soil Rock	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	2.0 886.0		LOAMY SAND, fine to coarse grained, trace Gravel and roots, dark brown, moist. (Topsoil Fill)							
	4.0 884.0		SAND, fine to coarse grained, brown with dark brown, moist. (Fill)		5	11				
5			PEAT, fibrous, dark brown, wet. (Swamp Deposit)		3	295				
	9.0 879.0				1	403				
10					2	159				
					TW	129		35	Cc=1.33, Cr=0.29 See Consolidation Test Report.	
15			PEAT, semi fibrous, trace shells, dark brown and black, wet. (Swamp Deposit)		5	110				
	19.0 869.0				TW*			*No thinwall sample recovery.		
20					5	71				
	24.0 864.0		SILTY CLAY LOAM, organic, gray and black, wet. (Swamp Deposit)		TW	27	688	98		See Unconfined Compression Report.
25			LOAMY SAND, fine to coarse grained, with Gravel, gray, waterbearing, loose. (Alluvium)							
Index Sheet Code 3.0 (Continued Next Page)				Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11						

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-8		888.0 (Surveyed)		
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N60	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
30	29.0	[Dotted Pattern]	LOAMY SAND, fine to coarse grained, with Gravel, gray, waterbearing, loose. (Alluvium) (continued)	[X]	6*	13				*Little sample recovery.
	859.0			[Wavy]						
			[X]	10*	12					
			[Wavy]							
			[X]	5	16					
			[Wavy]							
			[X]	7	18					
			[Wavy]							
			[X]	12	16					
			[Wavy]							
35		[Dotted Pattern]	SAND, fine to coarse grained, with Gravel, gray, waterbearing, loose to medium dense. (Alluvium)	[X]					P200=3% See Grain Size Accumulation Curve.	
				[Wavy]						
				[X]	23	20				
				[Wavy]						
40	39.0	[Dotted Pattern]	SANDY LOAM, plastic, trace Gravel, gray, wet, stiff. (Glacial Till)	[X]	11	10			LL=22, PI=13	
	849.0			[Wavy]						
45	42.0	[Diagonal Hatching]	SANDY CLAY LOAM, trace Gravel, gray, wet, stiff. (Glacial Till)	[X]	15	11				
	846.0			[Wavy]						
	45.0	[Dotted Pattern]	SAND, fine to coarse grained, with Gravel, with occasional Loamy Sand layers, brown, waterbearing, medium dense. (Glacial Outwash)	[X]	19	10				
	843.0			[Wavy]						
50		[Dotted Pattern]		[X]	15	21				
				[Wavy]						

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-8		888.0 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
55			SAND, fine to coarse grained, with Gravel, with occasional Loamy Sand layers, brown, waterbearing, medium dense. (Glacial Outwash) (continued)		15	14			P200=2% See Grain Size Accumulation Curve.
	59.0 829.0				24	16			
					13	10			
					15	9			
60			SANDY LOAM, non plastic, trace Gravel, reddish brown, moist to waterbearing, dense. (Glacial Till)		29	10			P200=29% See Grain Size Accumulation Curve.
	64.0 824.0				29*				*Little sample recovery.
65			LIMESTONE, highly weathered, gray.		50*73"				Apparent Top of Bedrock *Little sample recovery.
70	70.0 818.0		LIMESTONE, slightly weathered, hard, crinkly bedded, intensely to highly fractured, with Shale seams at 72-73 feet, gray.					NA	Auger refusal at 70 feet, switched to rock coring.
								NA	
	73.0 815.0		LIMESTONE, slightly weathered, hard, crinkly bedded, highly to moderately fractured, with Shale seam at 75 feet, gray.		70	0	0.00	6	PLATTEVILLE FORMATION
								6	
75								6	

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location			Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design			R-8		888.0 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Soil Rock	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
80	80.0		LIMESTONE, slightly weathered, hard, crinkly bedded, highly to moderately fractured, with Shale seam at 75 feet, gray. (continued)		100	93	0.78	0		PLATTEVILLE FORMATION
								2		
								2		
								2		
								1		
	808.0		END OF CORING. Water observed at 24 feet with 24 1/2 feet of hollow-stem auger in the ground. Boring immediately backfilled with bentonite grout.							

BRAUN
INTERTEC



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		R-9		897.7 (Surveyed)		
Location				Drill Machine				SHEET 1 of 4		
Co. Coordinate: X=504043 Y=153544 (ft.)				7514						
Latitude (North)=				Hammer				Drilling Completed		
Longitude (West)=				CME Automatic Calibrated				5/25/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N60	(%)	(psf)	(pcf)		Rock
					REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	2.0 895.7		SANDY LOAM, non plastic, dark brown, moist. (Topsoil Fill)							
	4.0 893.7		SANDY LOAM, slightly plastic, with Gravel and Sandy Clay seams, dark brown and brown, moist to wet. (Fill)		14	10				
5			LOAMY SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)		6	6				
			LOAMY SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)		14	6				
10			LOAMY SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)		24*					*No sample recovery.
	12.0 885.7		PEAT, fibrous, dark brown, moist. (Swamp Deposit)		7	295				
15			PEAT, fibrous, dark brown, moist. (Swamp Deposit)		TW	264	726	18		See U-U Test Report.
	17.0 880.7		CLAY, gray, wet. (Alluvium)		24	14				LL=22, PI=10
	18.5 879.2		LOAMY SAND, fine to coarse grained, trace gravel, gray, waterbearing, loose. (Alluvium)		9	14				
20			LOAMY SAND, fine to coarse grained, trace gravel, gray, waterbearing, loose. (Alluvium)		12	60				OC=14%
	22.0 875.7		PEAT, well decomposed, trace Gravel, with Sandy Loam seams, black and dark brown, wet. (Swamp Deposit)							
25			PEAT, well decomposed, trace Gravel, with Sandy Loam seams, black and dark brown, wet. (Swamp Deposit)							

Index Sheet Code 3.0

(Continued Next Page)

Soil Class:J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 2 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-9		897.7 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	26.0 871.7		PEAT, well decomposed, trace Gravel, with Sandy Loam seams, black and dark brown, wet. (Swamp Deposit) (continued)		TW*				*No thinwall sample recovery.
30			LOAMY SAND, fine to coarse grained, with Gravel and possible Boulders, gray, waterbearing, medium dense to dense. (Glacial Outwash)		17*	16			*Used 3" casing from 27 feet to rock coring.
					14	12			
					42*	15			*Little sample recovery.
35					36	16			P200=12% See Grain Size Accumulation Curve.
					29	15			
40					20	14			
	42.0 855.7		SANDY CLAY, trace Gravel, gray, wet, very stiff. (Glacial Till)		20	20			qp=2 3/4 tsf
	44.0 853.7		CLAY, trace Gravel, with Sand lenses, gray, wet, very stiff. (Glacial Till)						
45					22	23			qp=2 1/2 tsf LL=29, PI=16
	46.0 851.7		SAND, fine to coarse grained, with Gravel, brown, waterbearing, medium dense to dense. (Glacial Outwash)		24*				*No sample recovery.
50									

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 3 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design		R-9		897.7 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks	Formation or Member
	54.0 843.7		SAND, fine to coarse grained, with Gravel, brown, waterbearing, medium dense to dense. (Glacial Outwash) (continued)		32	24			P200=2% See Grain Size Accumulation Curve.
55									
			SAND, fine to medium grained, brown, waterbearing, medium dense. (Glacial Outwash)		19	20			
60									
	64.0 833.7								
65	65.0 832.7		GRAVEL, with Limestone fragments, brown, waterbearing, very dense. (Weathered Bedrock)		16	23			P200=3% See Grain Size Accumulation Curve.
					100/7"	12			Switched to rock coring at 65 feet to advance boring.
			Gravel, Cobbles and Limestone fragments.						
70									
	72.0 825.7								
			LIMESTONE, moderately weathered, hard, highly to intensely fractured, gray, with occasional vugs.						
								5	Apparent Top of Bedrock
								2	
								5	PLATTEVILLE FORMATION
75					90	26	0.43		

(Continued Next Page)

Soil Class: J. Van Abel Rock Class: J. Van Abel Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS

SHEET 4 of 4

State Project		Bridge No. or Job Desc.		Trunk Highway/Location			Boring No.		Ground Elevation	
				TH 7 & Louisiana Ave Design			R-9		897.7 (Surveyed)	
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N ₆₀	MC (%)	COH (psf)	γ (pcf)	Soil Rock	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Formation or Member
	76.0		With Shale seams from 75 to 76 feet. LIMESTONE, moderately weathered, hard, highly to intensely fractured, gray, with occasional vugs. (continued)					5	PLATTEVILLE FORMATION	
	821.7							3		
								2		
								4		
80			LIMESTONE, slightly weathered, hard, crinkly bedded, moderately fractured, gray.		100	84	0.84	1		
								1		
	82.0							2		
	815.7									

END OF CORING.
Water observed at 19 feet with 19 feet of hollow-stem auger in the ground.
Boring immediately backfilled with bentonite grout.

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-1		910.1 (Surveyed)		
Location Co. Coordinate: X=502118 Y=153197 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	1.0		12 1/2 inches Bituminous.							
	909.1									
5			LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, brown and dark brown, moist. (Fill)			3				P200=15% See Grain Size Accumulation Curve.
10										
	10.0									
	900.1									
Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-2		902.5 (Surveyed)		
Location Co. Coordinate: X=502310 Y=153288 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.1 901.4		13 1/2 inches Bituminous.							
	5		LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, brown, moist. (Fill)			5				P200=13%
	10.0 892.5		Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger. Boring immediately backfilled.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-3		898.4 (Surveyed)		
Location Co. Coordinate: X=502509 Y=153274 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.1 897.3		13 inches Bituminous.							
	3.0 895.4		SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)			8				P200=9%
5										
			SANDY LOAM, slightly plastic, trace Gravel, dark brown, moist. (Fill)							
10	10.0 888.4									
Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 5 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-4		896.5 (Surveyed)		
Location Co. Coordinate: X=502702 Y=153371 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.0 895.5		12 1/2 inches Bituminous.							
	3.0 893.5		SANDY LOAM, non plastic, trace Gravel, brown, moist. (Fill)			4				P200=12%
5										
	10.0 886.5		SANDY LOAM, non plastic, with Gravel, trace bituminous fragments, dark brown and brown, moist. (Fill)							
10			Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 7 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-5		896.6 (Surveyed)		
Location				Co. Coordinate: X=502894 Y=153412 (ft.)		Drill Machine 7514		SHEET 1 of 1		
				Latitude (North)= Longitude (West)=		Hammer NA		Drilling Completed 5/17/11		
				No Station-Offset Information Available						
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
					(%)	(%)	(ft)			
	1.1		13 1/2 inches Bituminous.							
	895.5									
	3.0		SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)							
	893.6									
5										
			LOAMY SAND, fine to coarse grained, with Gravel, dark brown, moist. (Fill)							
10										
	10.0									
	886.6									
<p>Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger. Boring immediately backfilled.</p>										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-6		896.7 (Surveyed)		
Location Co. Coordinate: X=503091 Y=153386 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/18/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation or Member
					(%)	(%)	(ft)	Breaks		
	1.1		13 inches Bituminous.							
	895.6									
	3.5		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
	893.2									
5										
			SANDY LOAM, trace Gravel to with Gravel, slightly plastic, dark brown, moist. (Fill)							
10										
	10.0									
	886.7									
Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 5 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-7		896.9 (Surveyed)		
Location Co. Coordinate: X=503288 Y=153429 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/19/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	0.9		11 inches Bituminous.							
	896.0									
			LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
	4.0									
	892.9									
5										
			LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, dark brown and brown, moist. (Fill)							
	10.0									
10	886.9									
Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 7 feet immediately after withdrawal of auger. Boring immediately backfilled.										

BRAUN
INTERTEC



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-8		898.5 (Surveyed)		
Location Co. Coordinate: X=503786 Y=153592 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/17/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N60	(%)	(psf)	(pcf)		Rock
					REC	RQD	ACL	Core Breaks		Formation or Member
					(%)	(%)	(ft)			
	1.0		12 1/2 inches Bituminous.							
	897.5									
	2.0		SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
	896.5									
5			LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, dark brown and brown, moist. (Fill)							
	7.0									
	891.5		SANDY LOAM, non plastic, with Gravel, dark brown, moist. (Fill)							
10	10.0									
	888.5		Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger. Boring immediately backfilled.							

Index Sheet Code 3.0

Soil Class:J. Van Abel Rock Class: Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-9		900.0 (Surveyed)		
Location Co. Coordinate: X=503976 Y=153629 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/17/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	1.2		14 1/2 inches Bituminous.							
	898.8									
	2.0		SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
	898.0									
5										
			LOAMY SAND, fine to coarse grained, trace Gravel to with Gravel, dark brown and brown, moist. (Fill)							
10										
	10.0									
	890.0									
Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-10		900.4 (Surveyed)		
Location Co. Coordinate: X=504172 Y=153599 (ft.)				Drill Machine 7513				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/20/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.2 899.2		14 inches Bituminous.							
	3.0 897.4		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)							
5			LOAMY SAND, fine to coarse grained, with Gravel, brown and dark brown, moist. (Fill)							
	7.0 893.4		CLAY, trace Gravel, with Sandy Loam seams, black and dark brown, wet. (Fill)							
10	10.0 890.4		Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed immediately after withdrawal of auger. Boring immediately backfilled.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-11		904.3 (Surveyed)		
Location Co. Coordinate: X=504375 Y=153704 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/17/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	1.1		13 inches Bituminous.							
	903.2		LOAMY SAND, fine to coarse grained, with Gravel (possible							
	2.0		Aggregate Base), brown, moist. (Fill)							
	902.3									
	5									
			LOAMY SAND, fine to coarse grained, trace Gravel to with							
			Gravel, dark brown and brown, moist. (Fill)							
	10									
	10.0		Bottom of Hole - 10 feet.							
	894.3		Water not observed while drilling.							
			Water not observed to cave-in depth of 7 1/2 feet							
			immediately after withdrawal of auger.							
			Boring immediately backfilled.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-12		903.4 (Surveyed)		
Location Co. Coordinate: X=504567 Y=153642 (ft.)				Drill Machine 7513				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/20/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation or Member
					(%)	(%)	(ft)	Breaks		
	1.2		14 inches Bituminous.							
	902.2									
	3.0		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)			3				
	900.4									
	4.0		CLAY, trace Gravel, slightly organic, black and brown, wet. (Fill)			17				
	899.4									
5			LOAMY SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)							
	6.0									
	897.4									
			SANDY LOAM, with Gravel, non plastic, dark brown, moist. (Fill)							
10	10.0									
	893.4									
<p>Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 7 feet immediately after withdrawal of auger. Boring immediately backfilled.</p>										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-13		906.6 (Surveyed)		
Location Co. Coordinate: X=504761 Y=153703 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/16/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.1 905.5		13 inches Bituminous.							
	2.0 904.6		LOAMY SAND, fine to coarse grained, with Gravel, brown. (Fill/Possible Aggregate Base)							
						7				
	5		SANDY LOAM, non plastic, trace Gravel to with Gravel, dark brown, moist. (Fill)							
	7.0 899.6									
			SAND, fine to coarse grained, with Gravel, brown, moist. (Possible Fill)							
	10.0 896.6									
<p>Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 7 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled.</p>										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-14		905.5 (Surveyed)		
Location				Co. Coordinate: X=504977 Y=153619 (ft.)		Drill Machine 7513		SHEET 1 of 1		
				Latitude (North)= Longitude (West)=		Hammer NA		Drilling Completed 5/20/11		
				No Station-Offset Information Available						
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.2		14 inches Bituminous.							
	904.3									
	3.0		LOAMY SAND, fine to coarse grained, trace Gravel, brown, moist. (Fill)			5				
	902.5									
5										
			LOAMY SAND, fine to coarse grained, with Gravel, dark brown and brown, moist. (Fill)							
10	10.0									
	895.5									
Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER

U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-15		907.7 (Surveyed)		
Location Co. Coordinate: X=505158 Y=153657 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/16/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	0.9		10 inches Bituminous.							
	906.8									
5			LOAMY SAND, fine to coarse grained, with Gravel, brown, dry to moist. (Fill)			4				P200=11% See Grain Size Accumulation Curve.
10										
	10.0									
	897.7									
Bottom of Hole - 10 feet. Water not observed while drilling. Water not observed to cave-in depth of 7 1/2 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-17		893.8 (Surveyed)		
Location Co. Coordinate: X=503485 Y=153942 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/13/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.4		17 inches Bituminous.							
	892.4									
	3.0		LOAMY SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)							
	890.8									
	5		SAND, fine to coarse grained, trace Gravel to with Gravel, brown, dry to moist. (Fill)			2				P200=4% See Grain Size Accumulation Curve.
	6.0									
	887.8		Bottom of Hole - 6 feet. Water not observed while drilling. Water not observed to cave-in depth of 5 feet immediately after withdrawal of auger. Boring immediately backfilled.							

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-18		896.2 (Surveyed)		
Location Co. Coordinate: X=503533 Y=153656 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/13/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation
					(%)	(%)	(ft)	Breaks		or Member
	1.0		12 inches Bituminous.							
	895.2					5				
	5									
	6.0		SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)							
	890.2									
Bottom of Hole - 6 feet. Water not observed while drilling. Water not observed to cave-in depth of 5 feet immediately after withdrawal of auger. Boring immediately backfilled.										

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION



UNIQUE NUMBER
U.S. Customary Units



State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-19		894.6 (Surveyed)		
Location Co. Coordinate: X=503587 Y=153376 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 6/10/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core	Rock	Formation or Member
					(%)	(%)	(ft)	Breaks		
	1.0		12 inches Bituminous.							
	893.6					4				
			SAND, fine to coarse grained, trace Gravel to with Gravel, brown, moist. (Fill)							P200=8% See Grain Size Accumulation Curve.
	5									
	6.0									
	888.6									
Bottom of Hole - 6 feet. Water not observed while drilling. Water not observed to cave-in depth of 5 feet immediately after withdrawal of auger. Boring immediately backfilled.										

BRAUN
INTERTEC

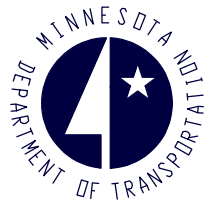


State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-20		891.4 (Surveyed)		
Location Co. Coordinate: X=503714 Y=153118 (ft.)						Drill Machine 7514			SHEET 1 of 1	
Latitude (North)= Longitude (West)=						Hammer NA			Drilling Completed 5/13/11	
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT N60	MC (%)	COH (psf)	γ (pcf)	Soil	Other Tests Or Remarks
	Elev.				REC (%)	RQD (%)	ACL (ft)	Core Breaks		Rock
	0.7 890.7		8 1/2 inches Bituminous.							
	5		SAND, fine to coarse grained, with Gravel, brown, dry to moist. (Fill)			3				P200=8% See Grain Size Accumulation Curve.
	6.0 885.4		Bottom of Hole - 6 feet. Water not observed while drilling. Water not observed to cave-in depth of 5 feet immediately after withdrawal of auger. Boring immediately backfilled.							

Index Sheet Code 3.0

Soil Class:J. Van Abel Rock Class: Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745A-MNDOT.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION
LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

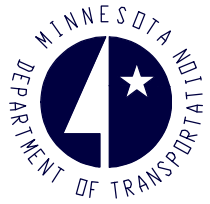


UNIQUE NUMBER
U.S. Customary Units

State Project		Bridge No. or Job Desc.		Trunk Highway/Location		Boring No.		Ground Elevation		
				TH 7 & Louisiana Ave Design		S-21		892.2 (Surveyed)		
Location Co. Coordinate: X=503863 Y=152704 (ft.)				Drill Machine 7514				SHEET 1 of 1		
Latitude (North)= Longitude (West)=				Hammer NA				Drilling Completed 5/13/11		
No Station-Offset Information Available										
DEPTH	Depth	Lithology	Classification	Drilling Operation	SPT	MC	COH	γ	Soil	Other Tests
	Elev.				N ₆₀	(%)	(psf)	(pcf)		Or Remarks
					REC	RQD	ACL	Core Breaks	Rock	Formation or Member
	1.8		22 inches Bituminous.							
	890.4					4				
	5		LOAMY SAND, fine to coarse grained, with Gravel, brown, moist. (Fill)							P200=16% See Grain Size Accumulation Curve.
	6.0									
	886.2									
Bottom of Hole - 6 feet. Water not observed while drilling. Water not observed to cave-in depth of 5 feet immediately after withdrawal of auger. Boring immediately backfilled.										

Appendix B

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

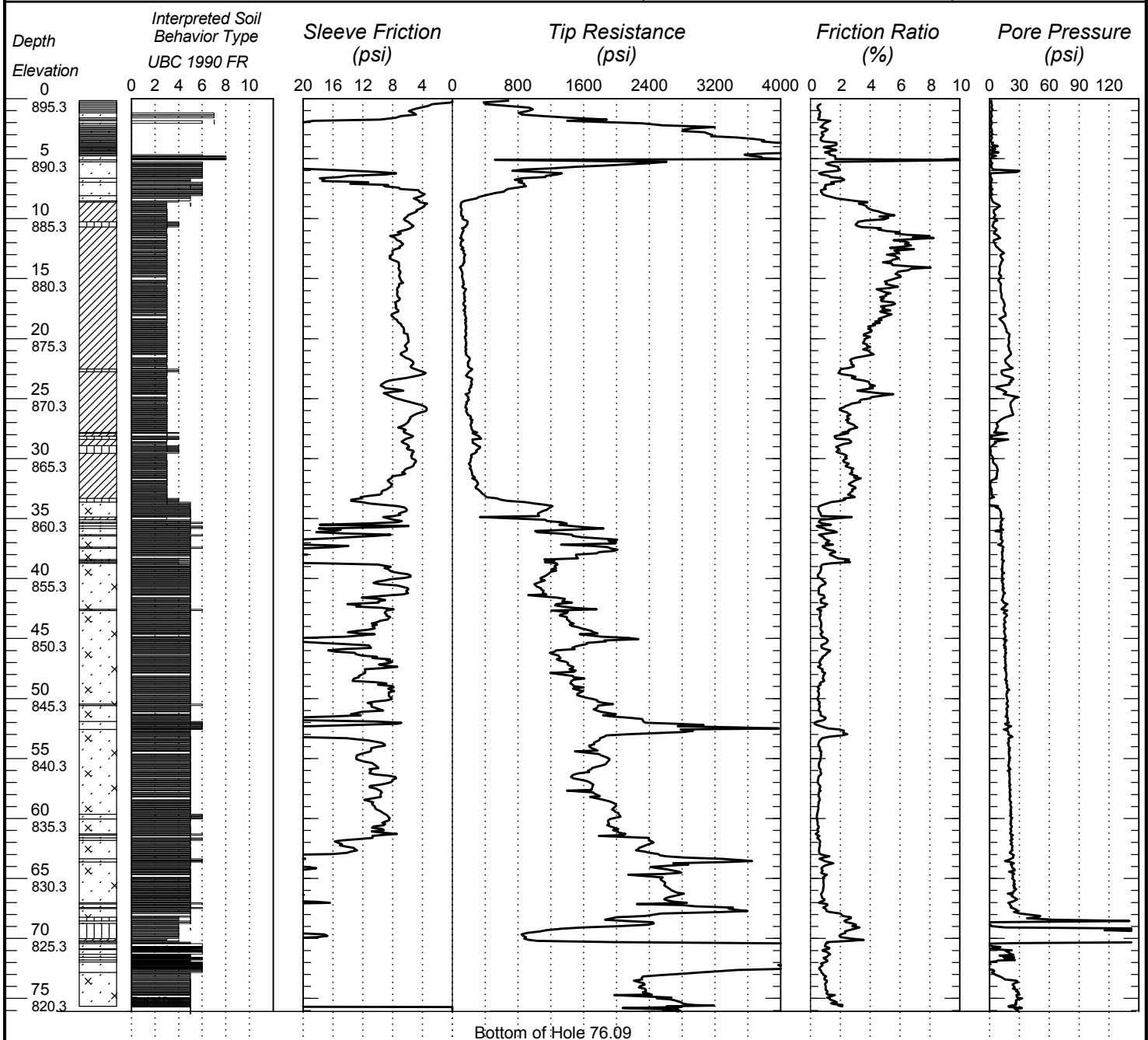

BRAUN™
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-01	895.3 ()
Location	Co. Coordinate: X=503204 Y=153502 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/18/11



Bottom of Hole 76.09

Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

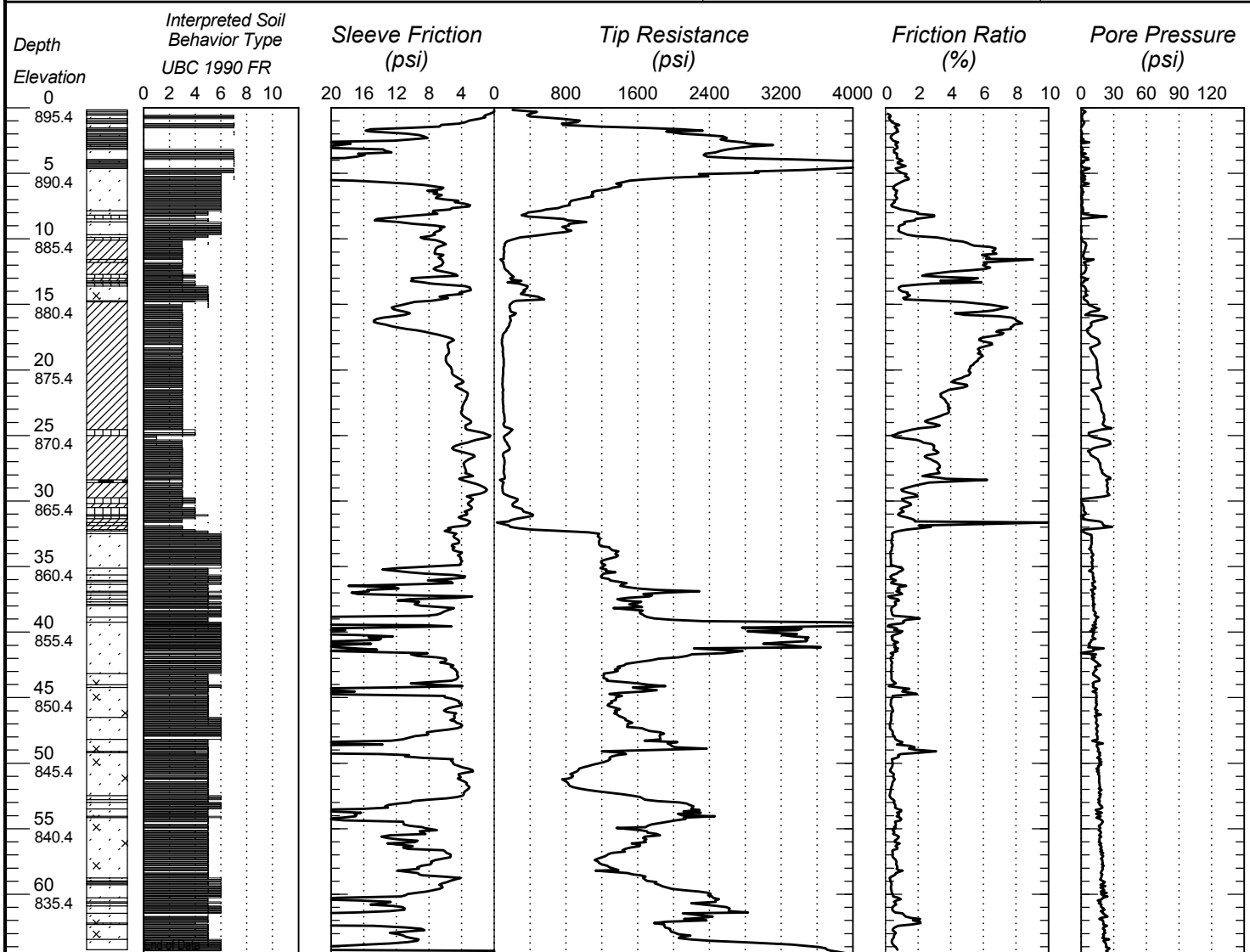

BRAUN™
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-02	895.4 ()
Location	Co. Coordinate: X=503300 Y=153528 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/17/11



Bottom of Hole 64.67

Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION



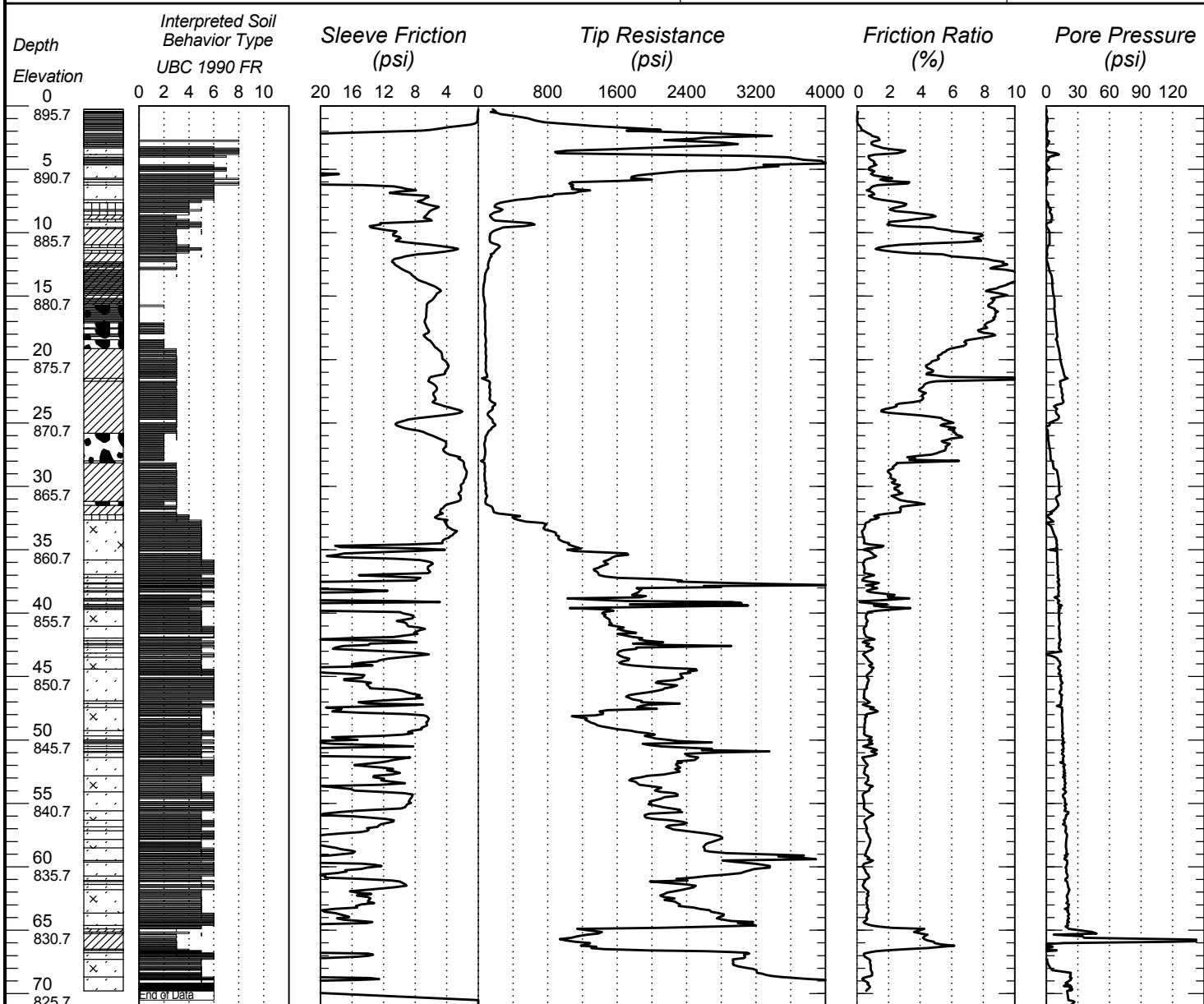
BRAUN
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-03	895.7 ()
Location	Co. Coordinate: X=503400 Y=153554 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/17/11



Bottom of Hole 70.91

Index Sheet Code

Soil Class: Rock Class: Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIXMNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

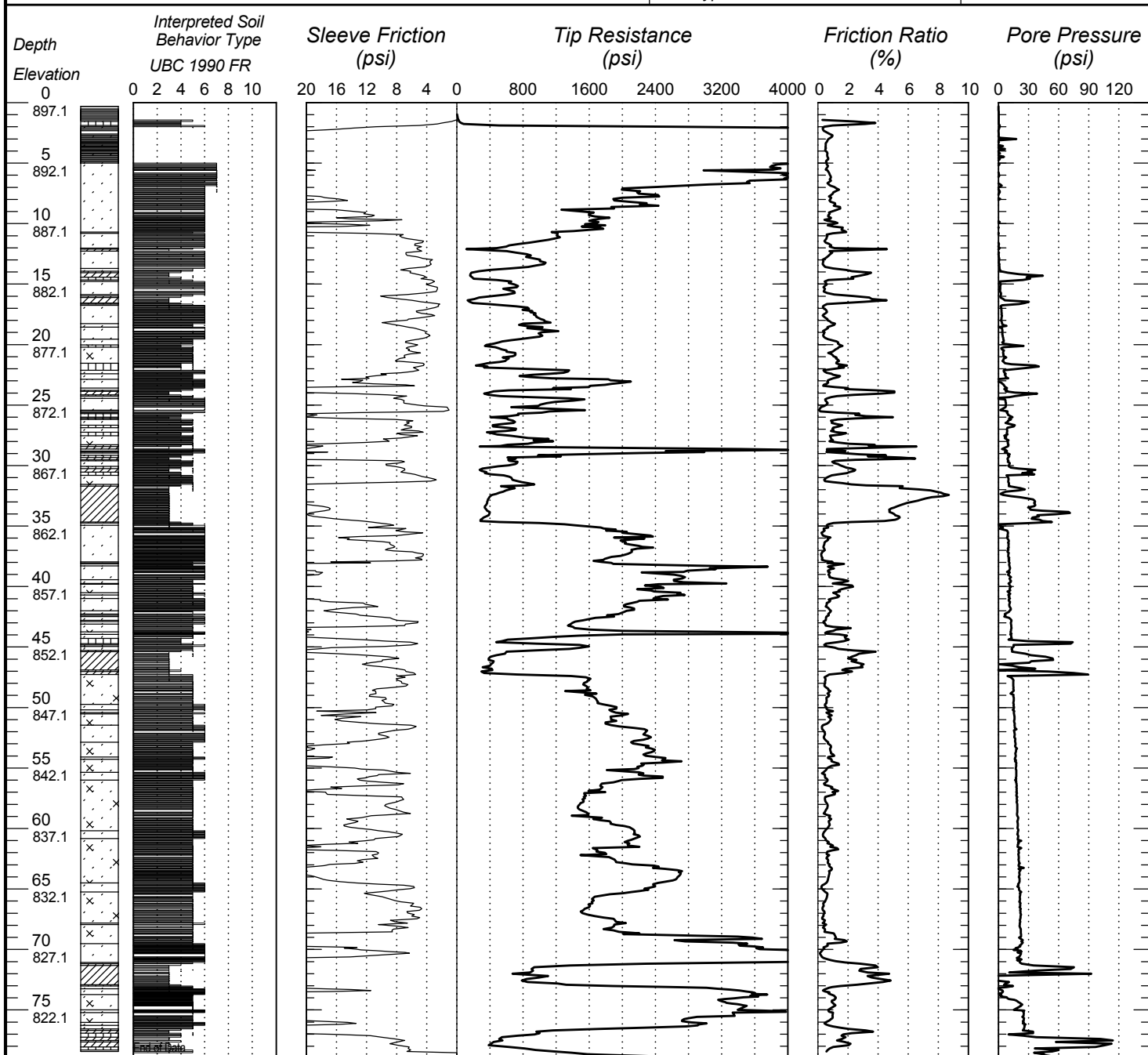

BRAUN
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-04	897.1 ()
Location	Co. Coordinate: X=503391 Y=153449 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/19/11



Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIXMNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

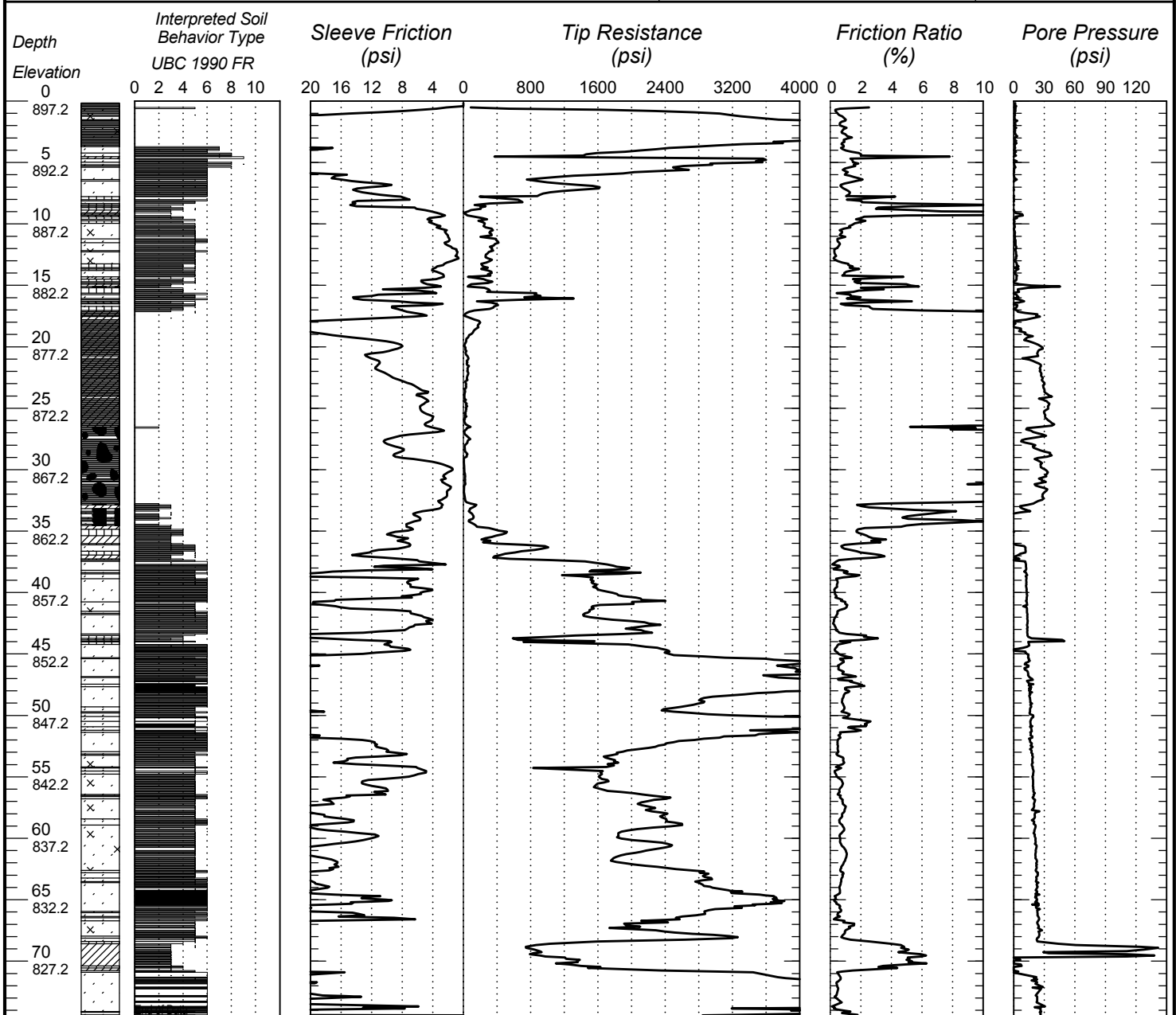

BRAUN
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-05	897.2 ()
Location	Co. Coordinate: X=503449 Y=153525 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/17/11



Bottom of Hole 74.78

Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

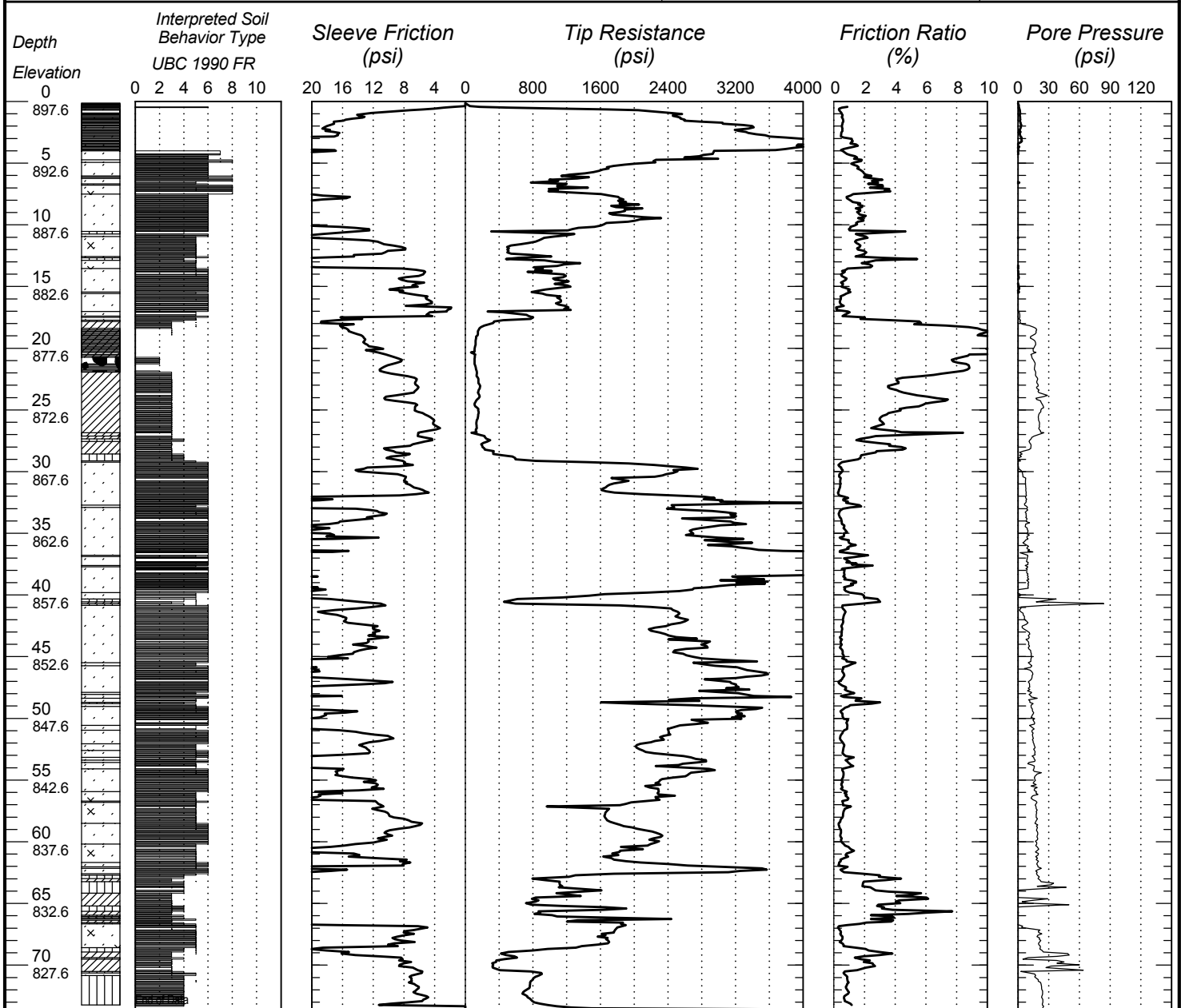

BRAUN™
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-06	897.6 ()
Location	Co. Coordinate: X=503673 Y=153590 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/16/11



Bottom of Hole 73.64

Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

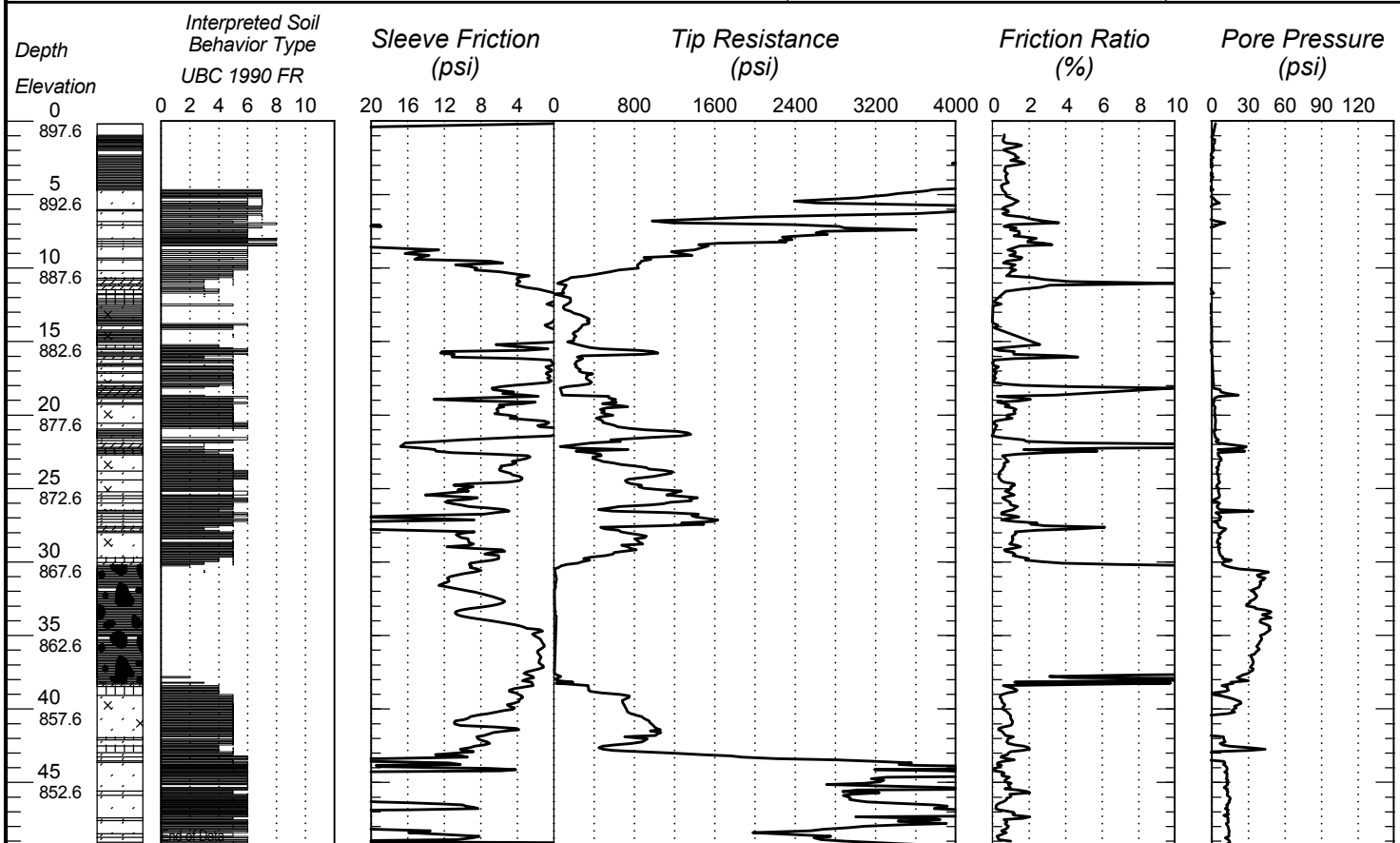

BRAUN
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-07	897.6 ()
Location	Co. Coordinate: X=503691 Y=153475 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/19/11



Bottom of Hole 49.52

Note: Offset 5 feet and redrilled.
 Cone refusal at 42.7 feet at offset location.

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION



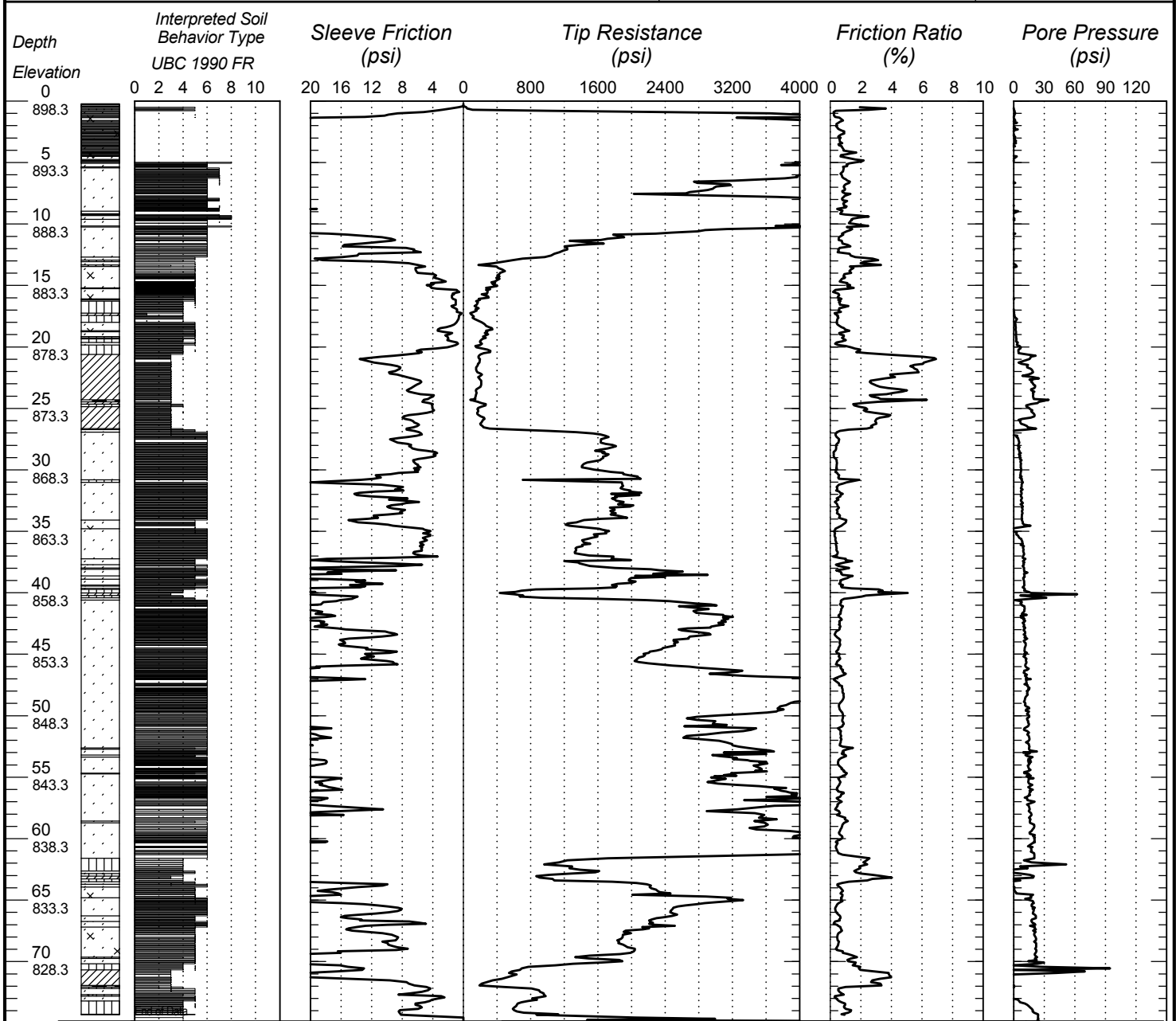
BRAUN
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-08	898.3 ()
Location	Co. Coordinate: X=503737 Y=153583 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)=	Longitude (West)=	CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/16/11



Bottom of Hole 74.84

Index Sheet Code

Soil Class: Rock Class: Edit: Date: 9/26/11
N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

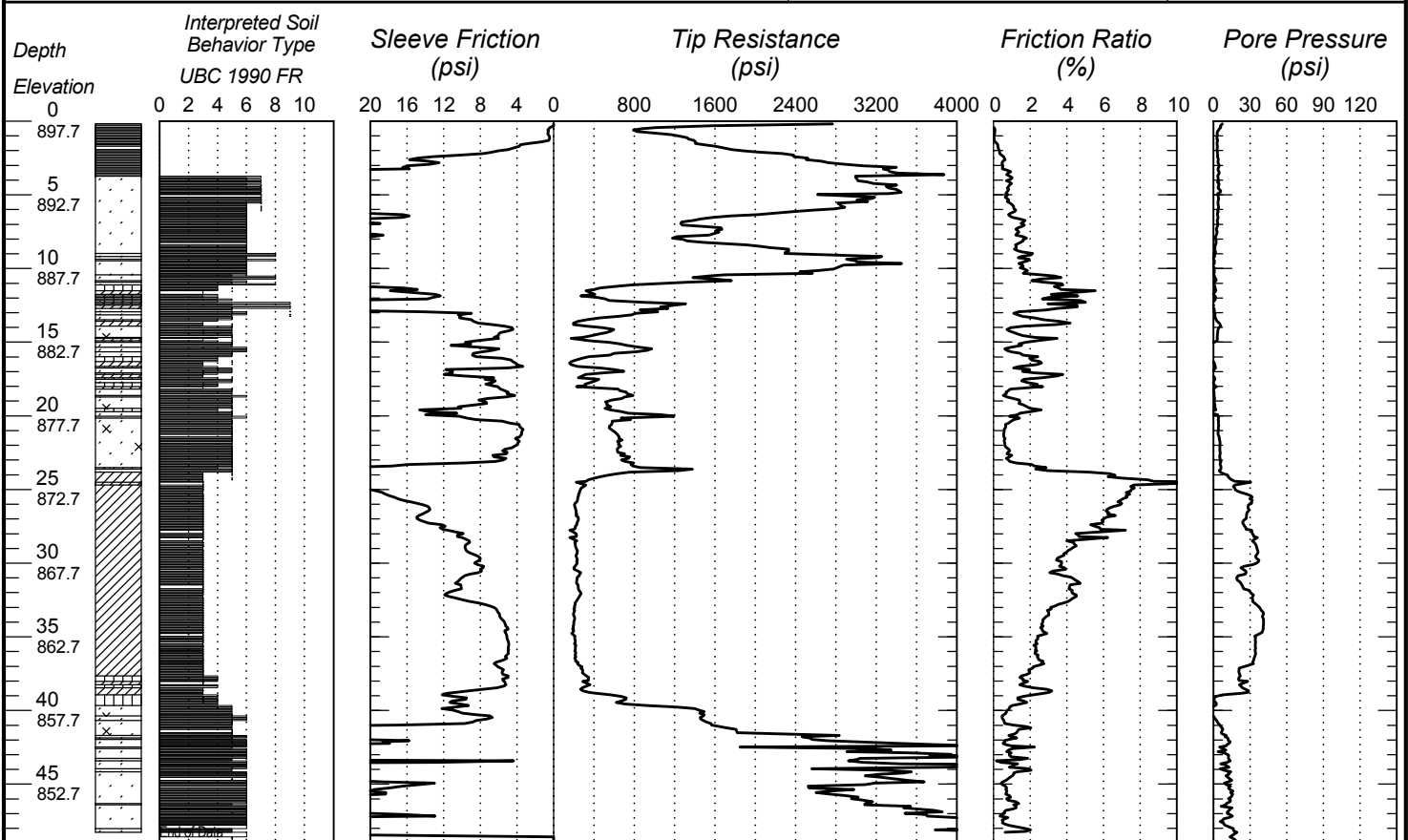

BRAUN™
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-09	897.7 ()
Location	Co. Coordinate: X=503753 Y=153488 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/18/11

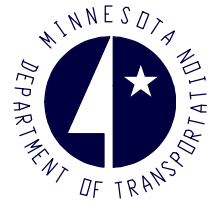


Bottom of Hole 49.05

Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

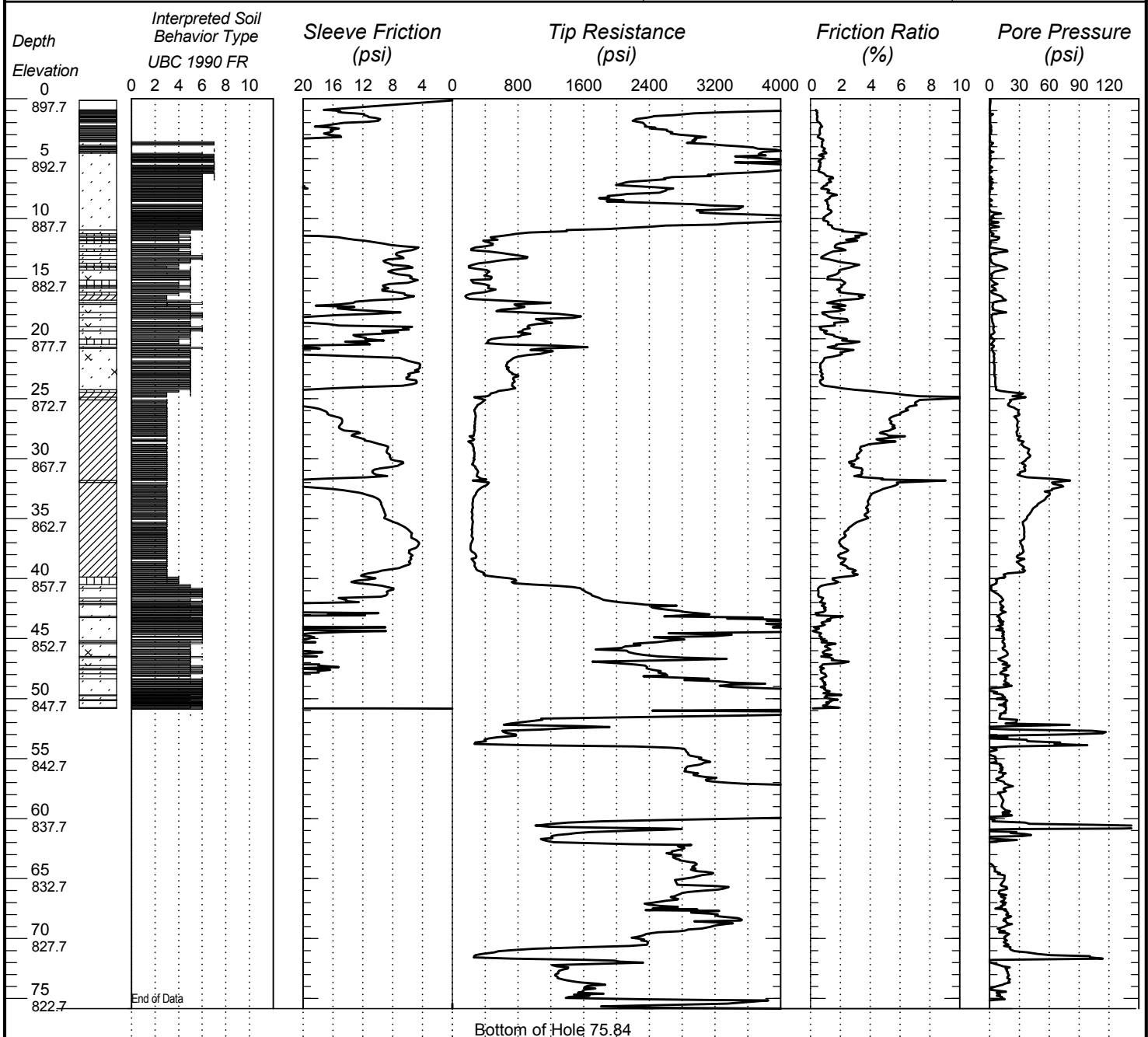

BRAUN™
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-09A	897.7 ()
Location	Co. Coordinate: X=503753 Y=153488 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/18/11



Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

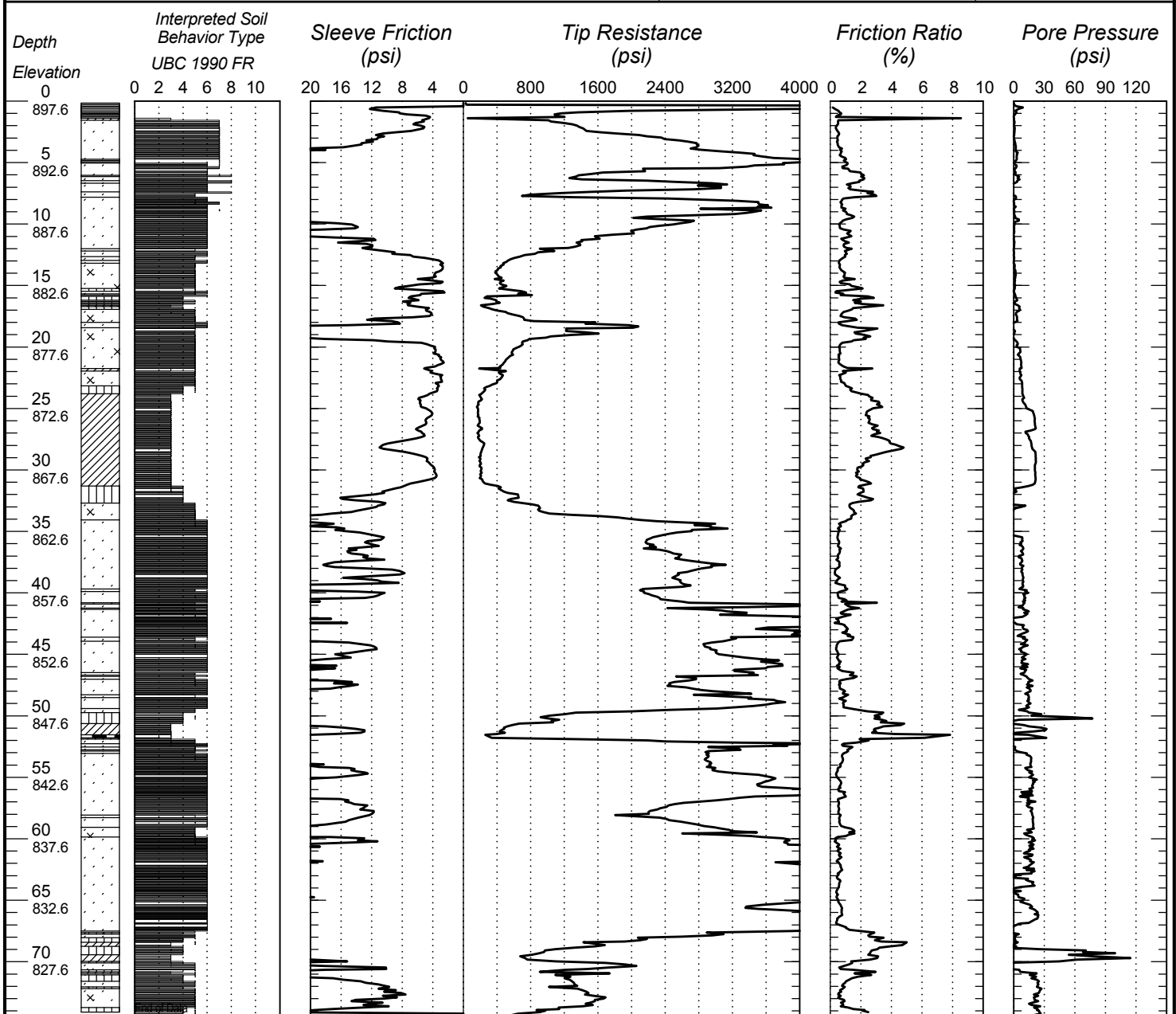

BRAUN
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-10	897.6 ()
Location	Co. Coordinate: X=503845 Y=153505 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/18/11



Bottom of Hole 74.6

Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

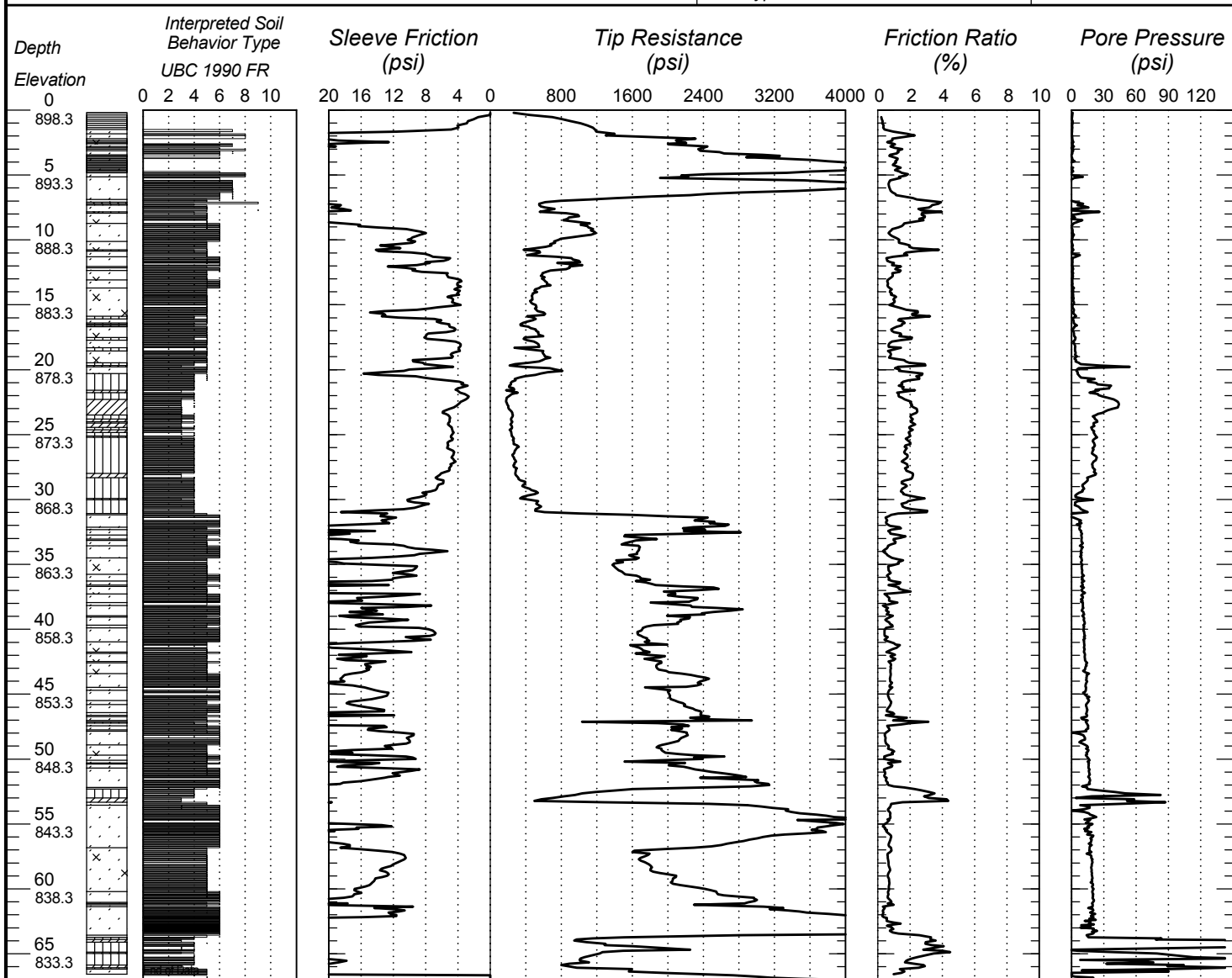

BRAUN™
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-11	898.3 ()
Location	Co. Coordinate: X=503945 Y=153533 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/18/11



Bottom of Hole 67.08

Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

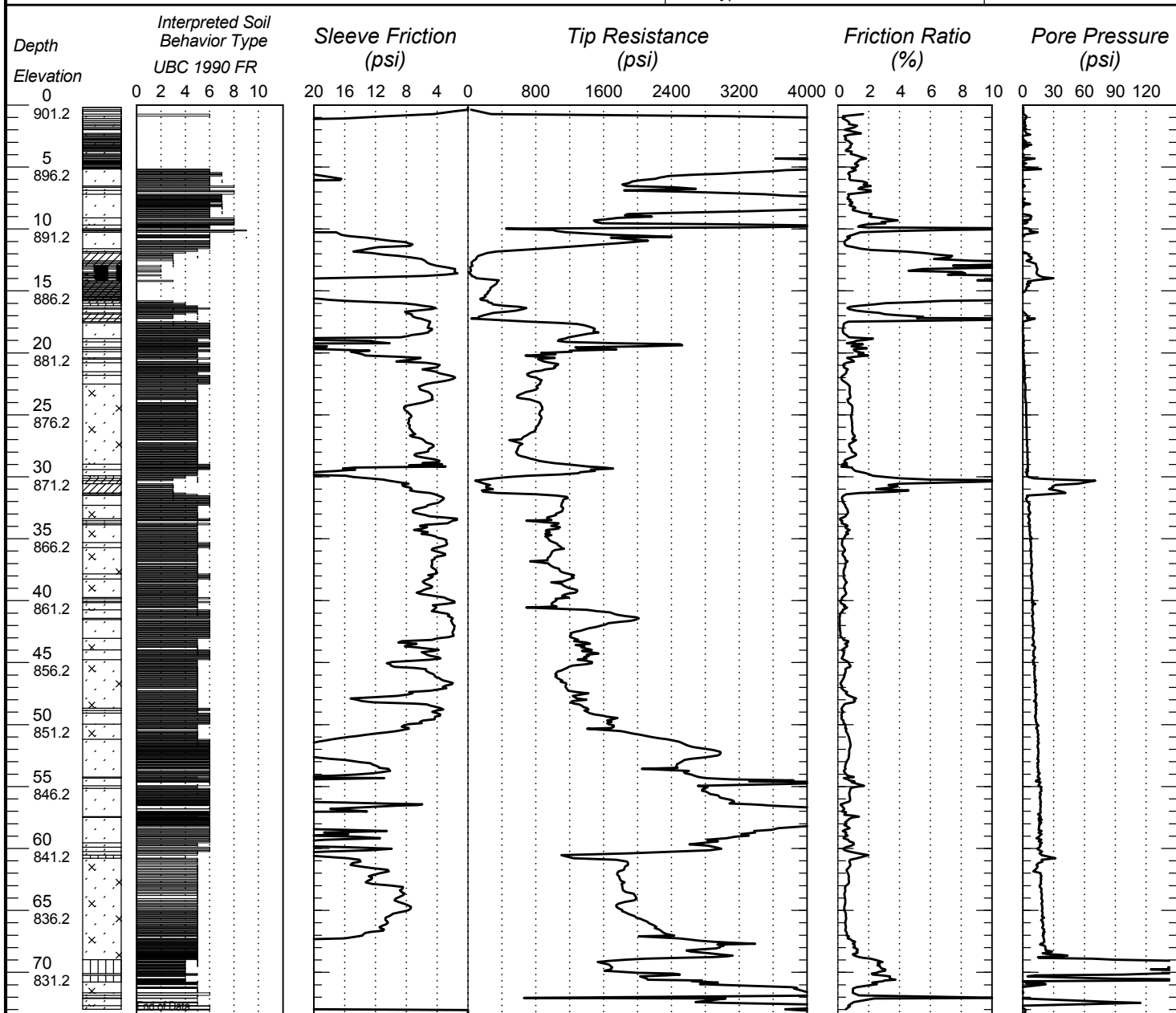

BRAUN
INTERTEC

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
		TH 7 & Louisiana Ave	C-12	901.2 ()
Location	Co. Coordinate: X=504075 Y=153651 (ft.)		CPT Machine CPT-1	SHEET 1 of 1
	Latitude (North)= Longitude (West)=		CPT Operator Rowland	Date Completed
	No Station-Offset Information Available		Hole Type CPT-SEISMIC/PWP-DISS	5/16/11



Bottom of Hole 73.58

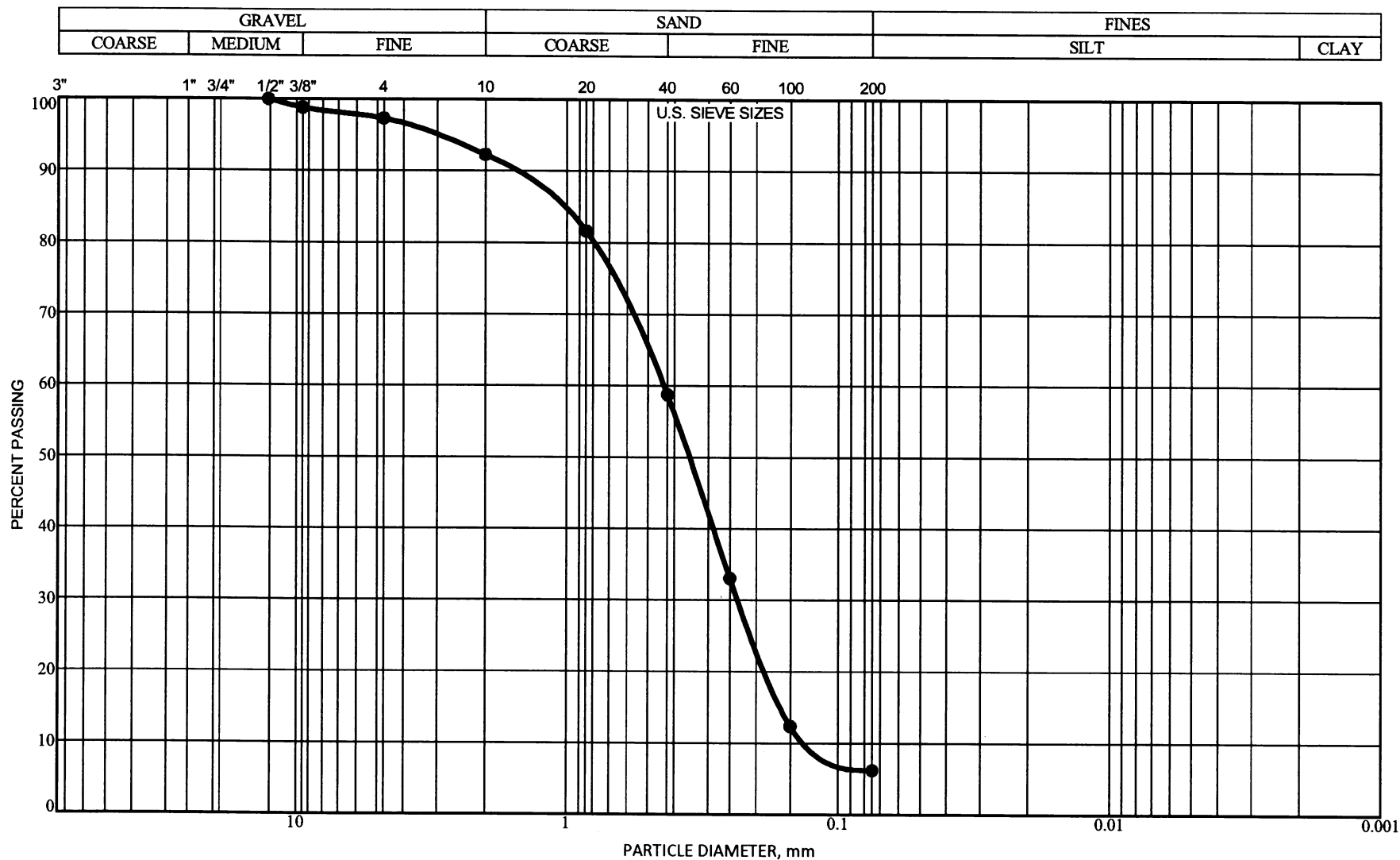
Index Sheet Code

 Soil Class: Rock Class: Edit: Date: 9/26/11
 N:\GINT\PROJECTS\MINNEAPOLIS\2009\00745ACPT_FIX\MNDOT1.GPJ

Appendix C

M:\DOT\VERSION2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: B-1 DEPTH: 2.5'

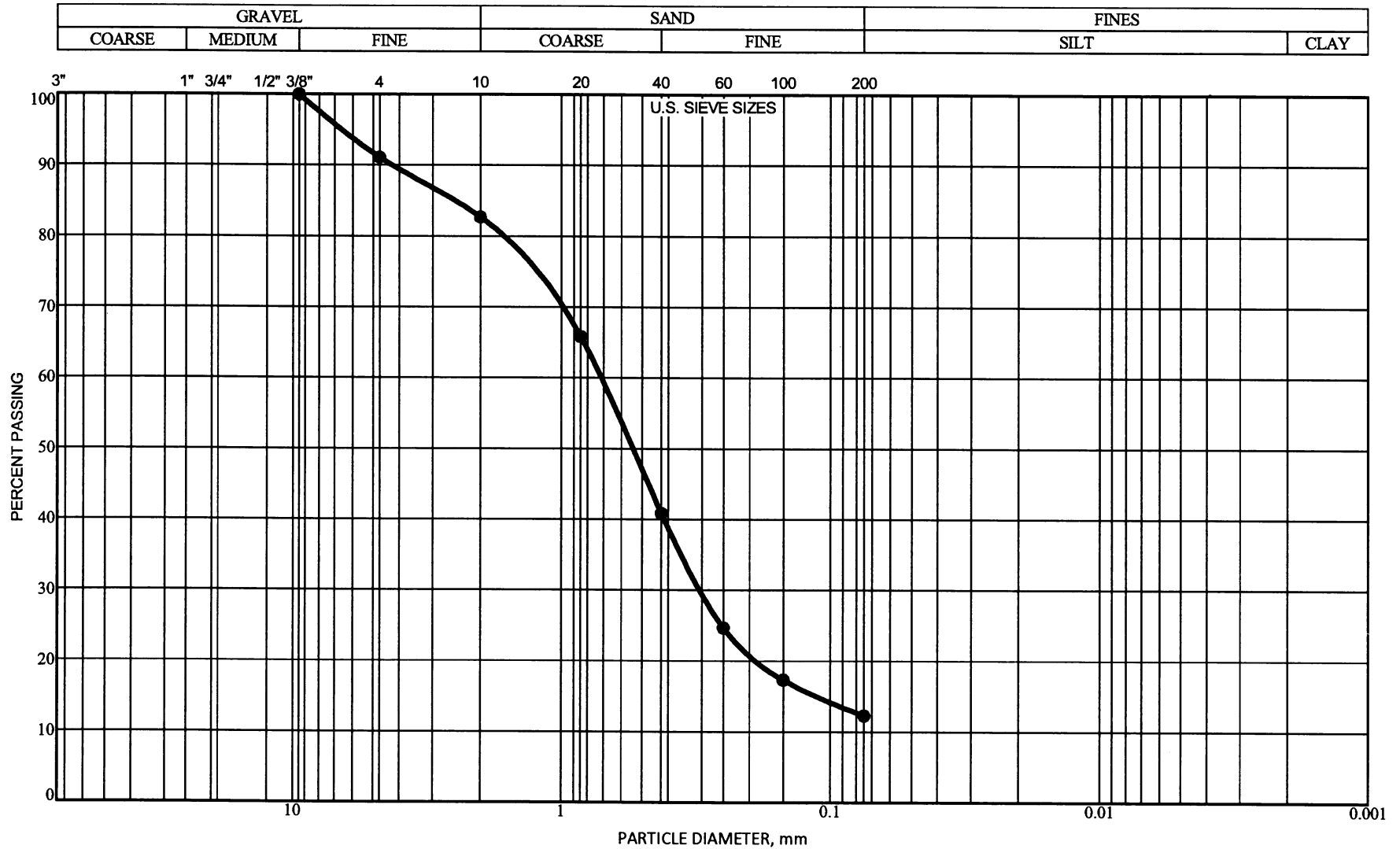
GRAVEL	7.7%
SAND	86.1%
FINES	6.2%

Mn/DOT Classification: SAND

BL-09-00745A

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

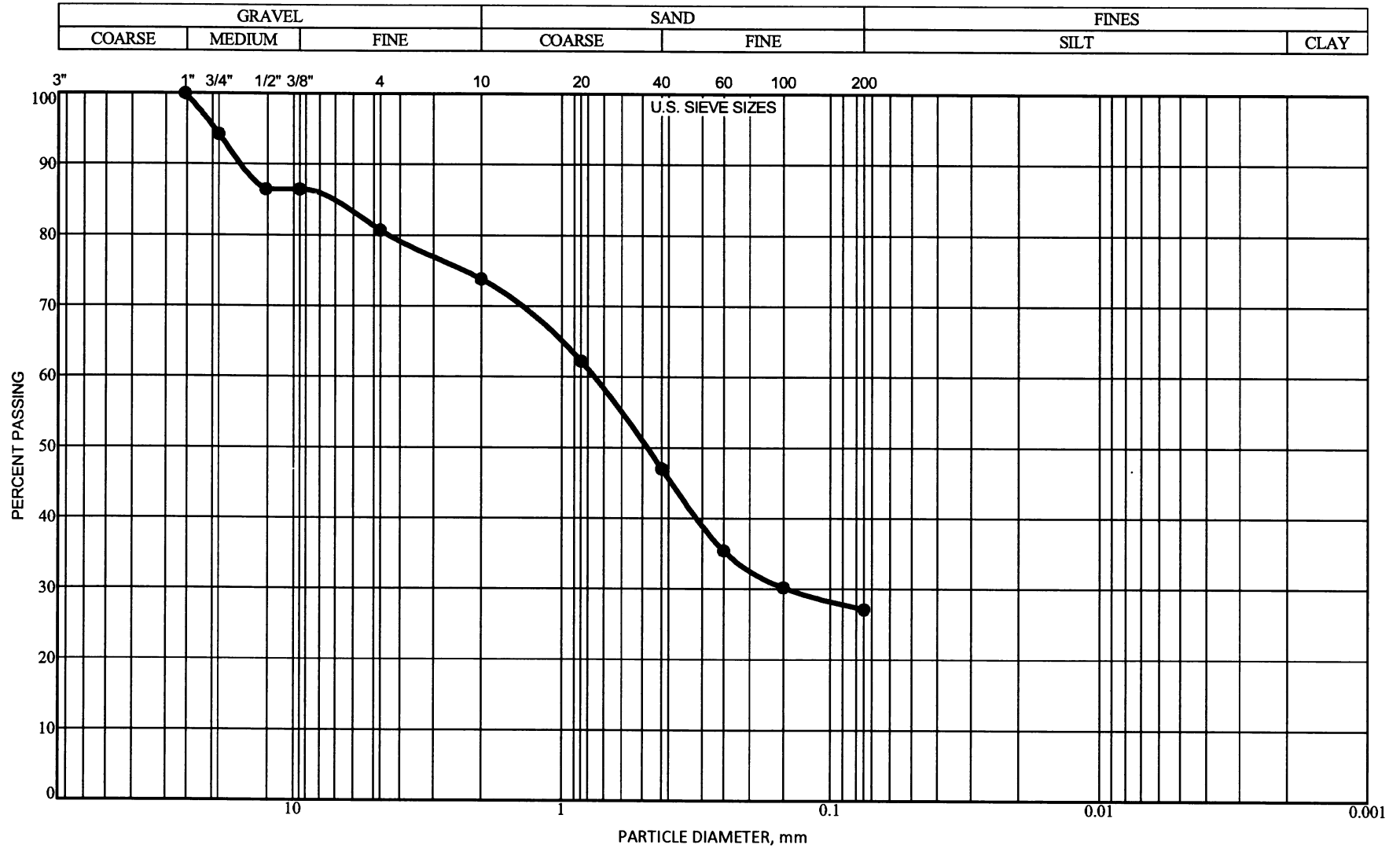
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
 BORING: B-2 DEPTH: 1.0'

GRAVEL	17.3%
SAND	70.4%
FINES	12.3%

Mn/DOT Classification: Loamy SAND

MINDOT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

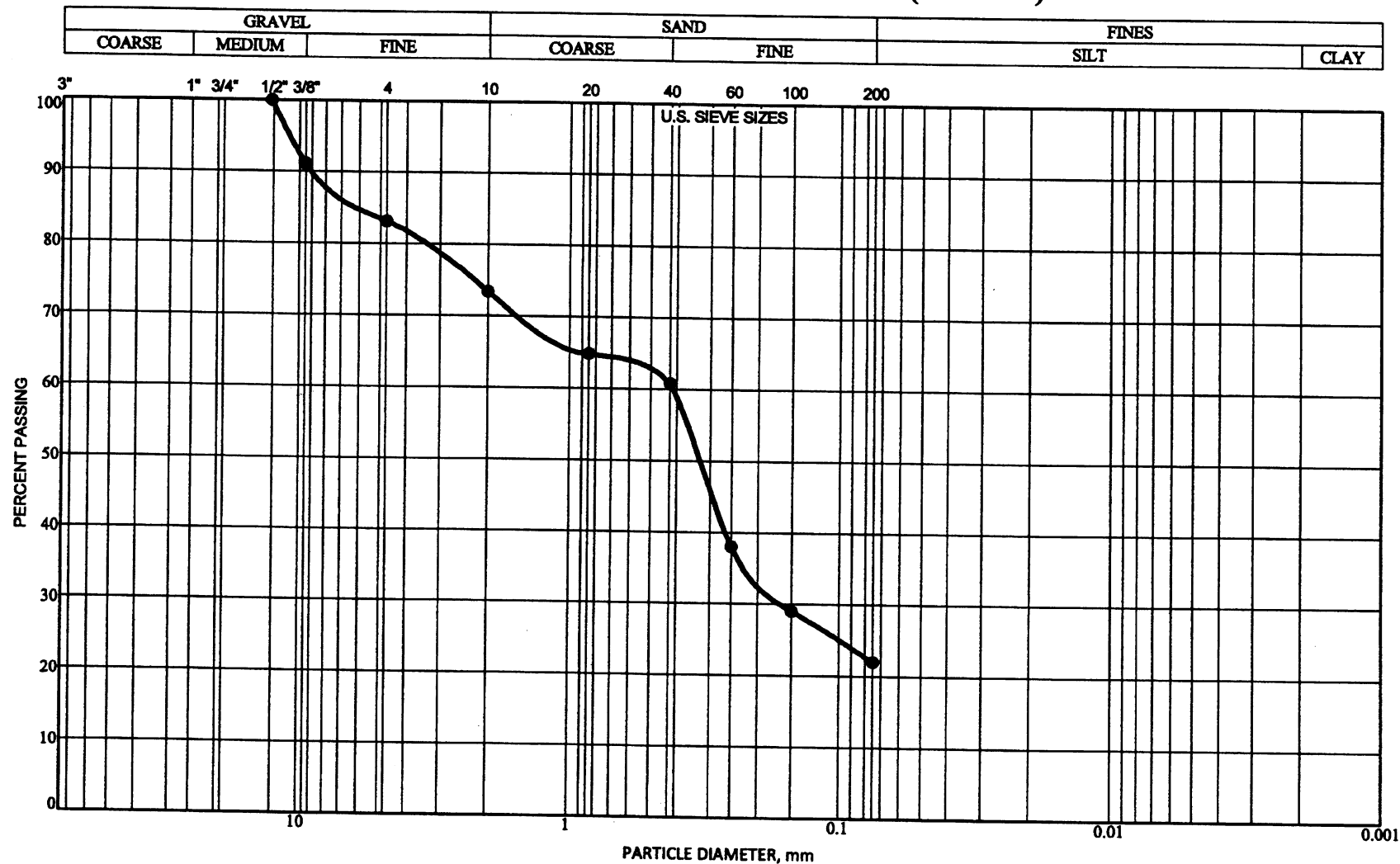
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: B-3 DEPTH: 2.5'

GRAVEL	26.2%
SAND	46.7%
FINES	27.1%

Mn/DOT Classification: SANDY LOAM

M:\DOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM

INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: B-4 DEPTH: 1.0'

GRAVEL	26.5%
SAND	51.4%
FINES	22.0%

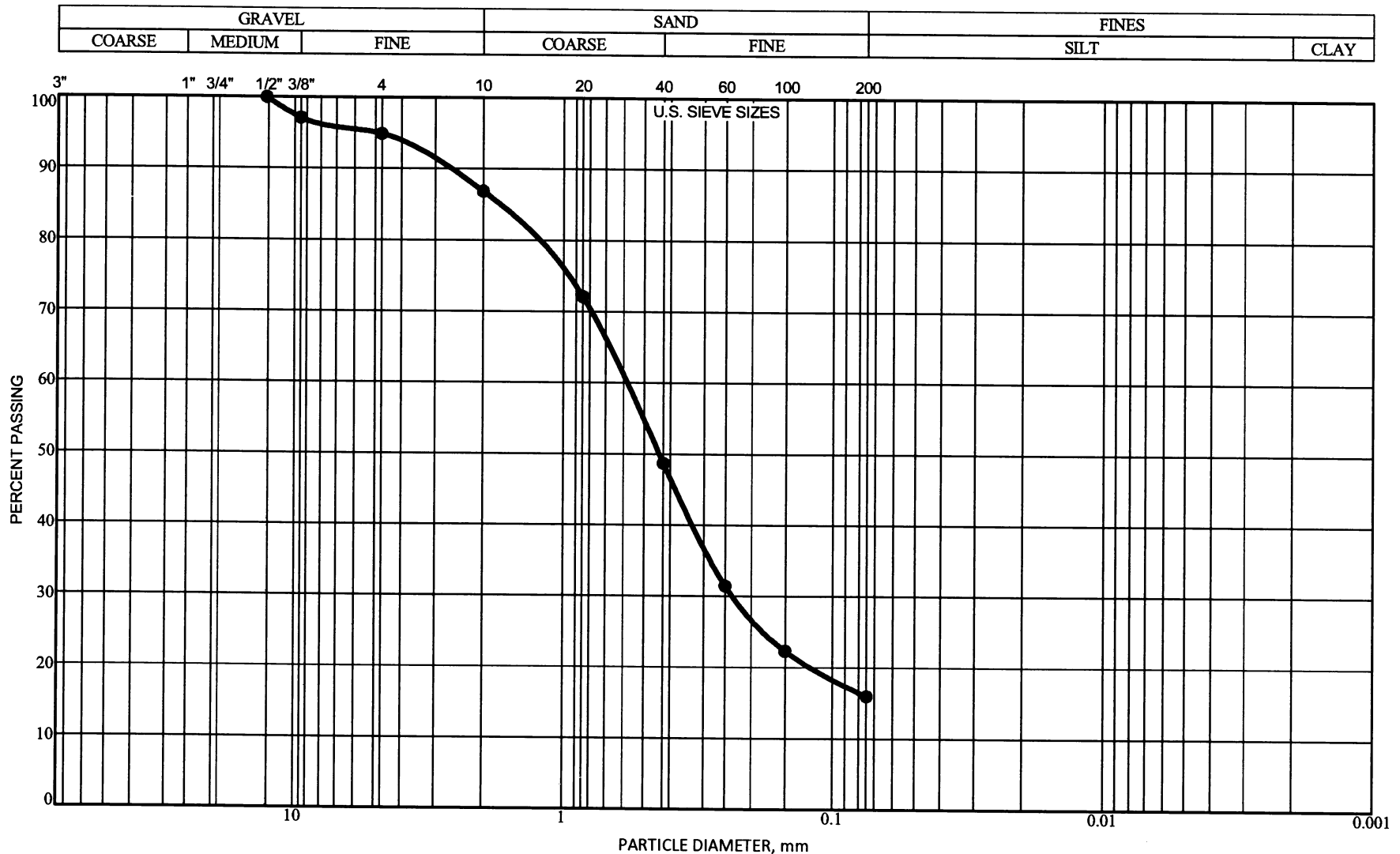
Mn/DOT Classification: SANDY LOAM
with GRAVEL

BL-09-00745A

Braun Intertec Corporation

MNDOT\PERSON2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_v8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: B-5 DEPTH: 1.5'

GRAVEL	13.1%
SAND	70.9%
FINES	16.0%

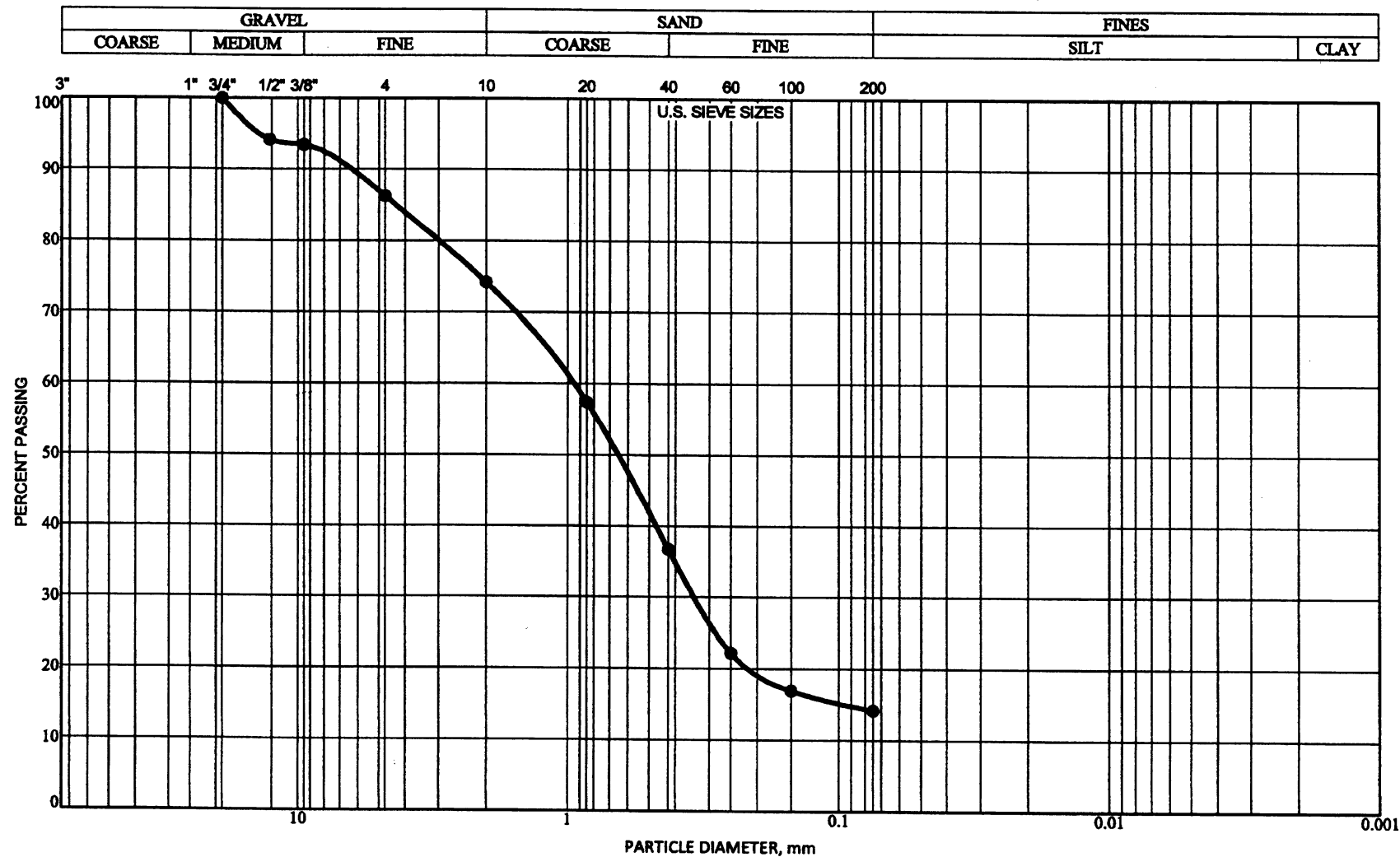
Mn/DOT Classification: Loamy SAND

BL-09-00745A

Braun Intertec Corporation

M:\DOT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: B-8 DEPTH: 2.5'

GRAVEL	25.8%
SAND	60.1%
FINES	14.2%

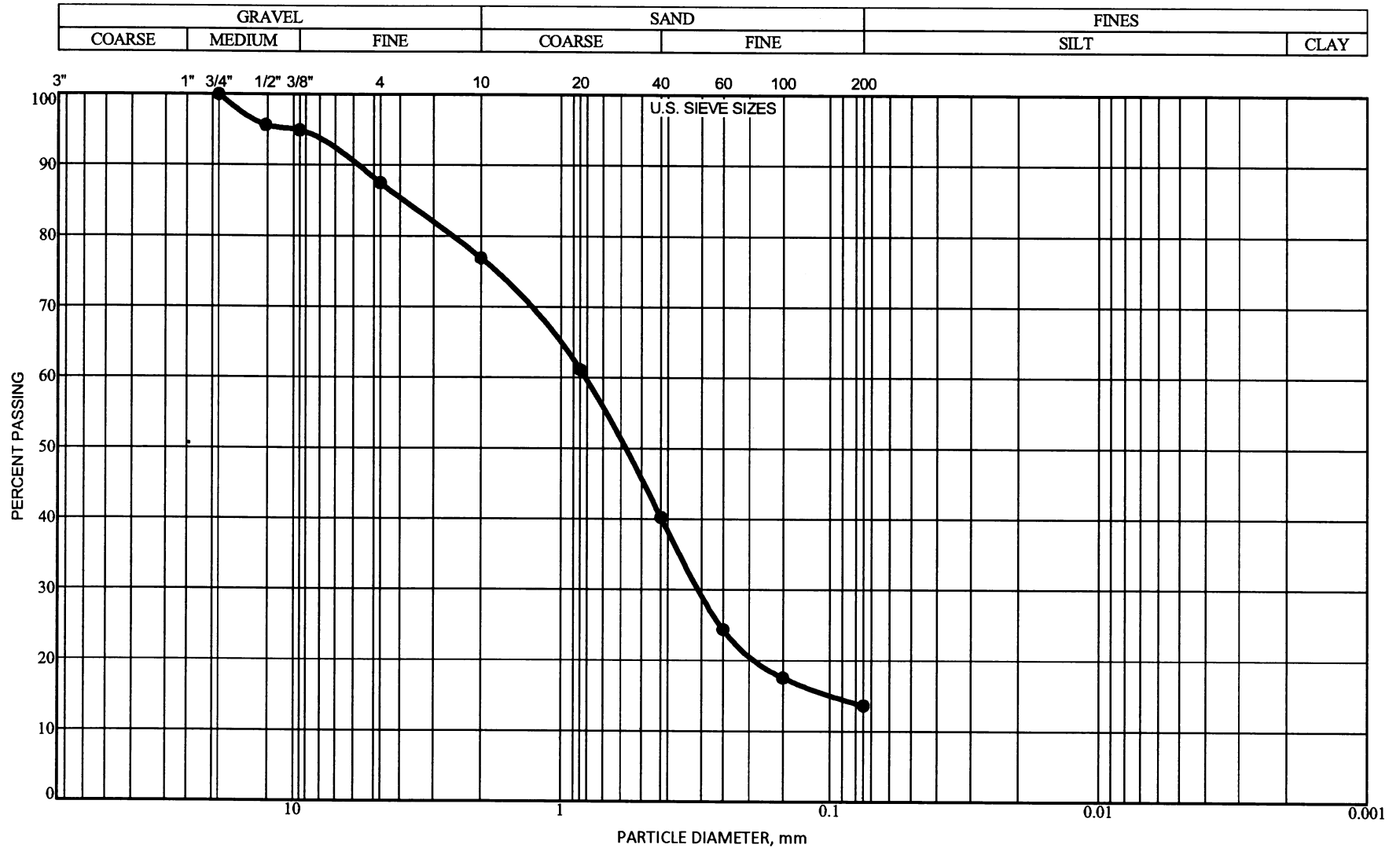
Mn/DOT Classification: Loamy SAND
with GRAVEL

BL-09-00745A

Braun Intertec Corporation

MNDOT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

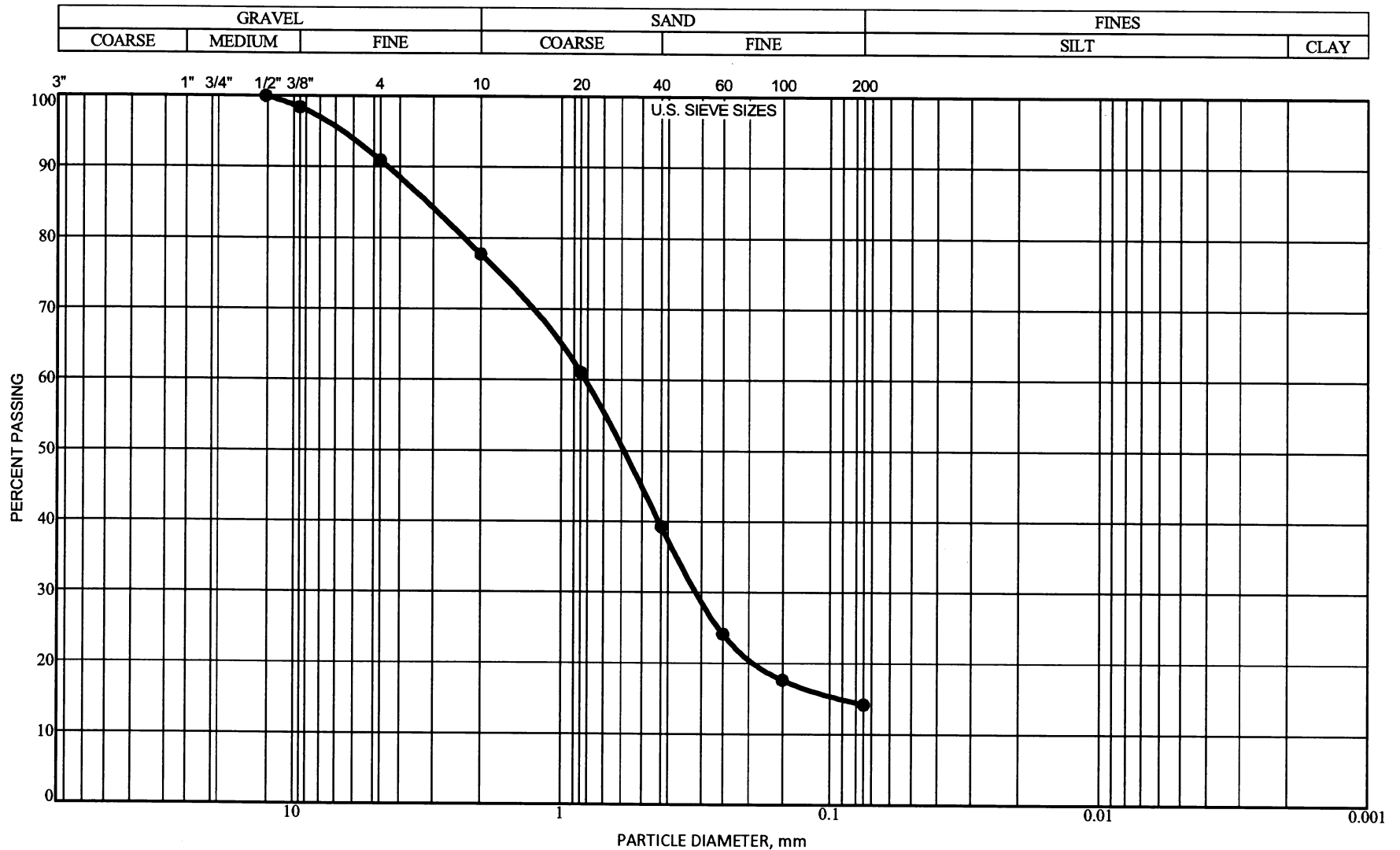
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: B-9 DEPTH: 2.5'

GRAVEL	23.1%
SAND	63.3%
FINES	13.6%

Mn/DOT Classification: Loamy SAND

MNDOT\PERSON2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: B-11 DEPTH: 2.5'

GRAVEL	22.3%
SAND	63.6%
FINES	14.2%

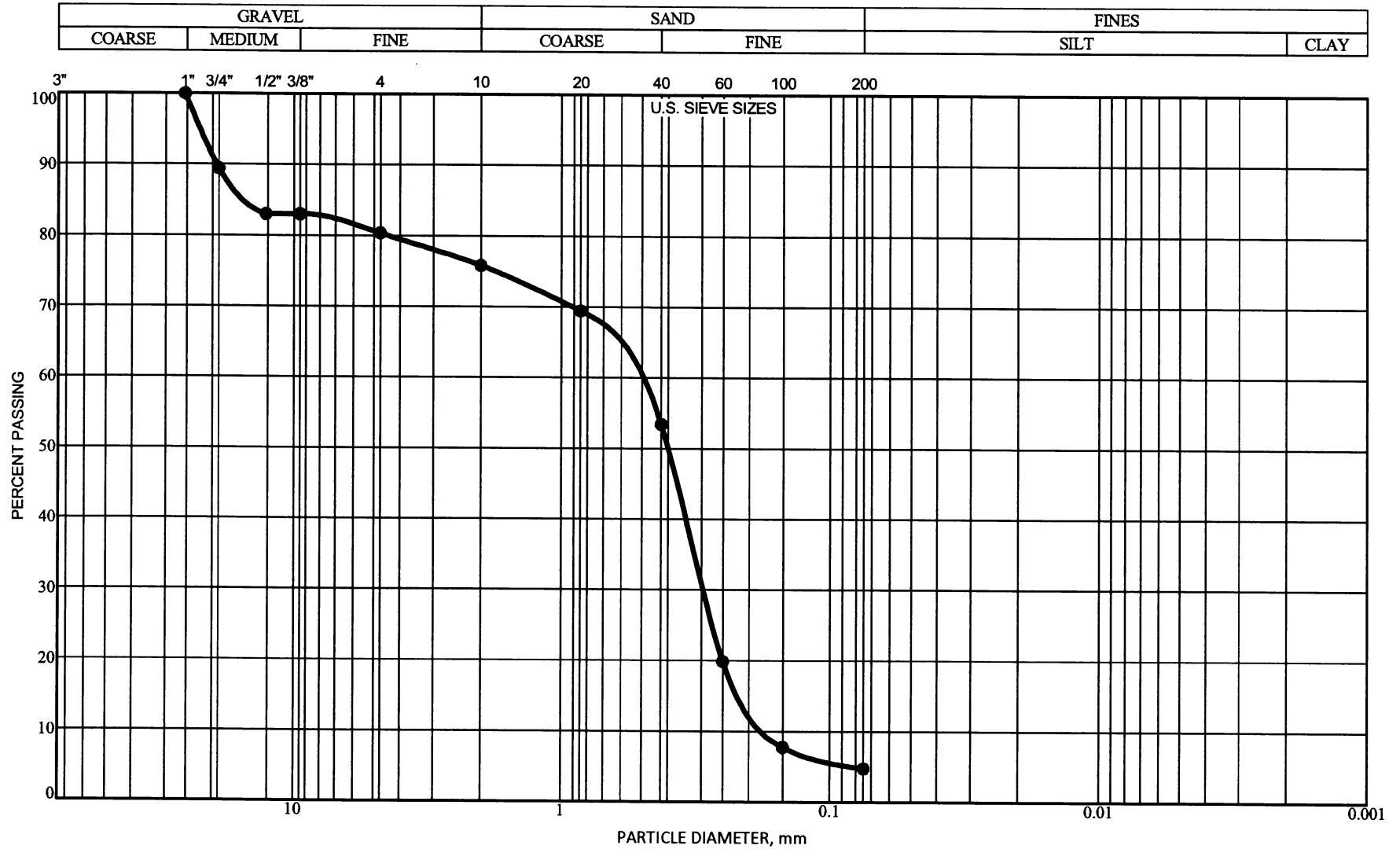
Mn/DOT Classification: Loamy SAND

BL-09-00745A

Braun Intertec Corporation

MINDOTVERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

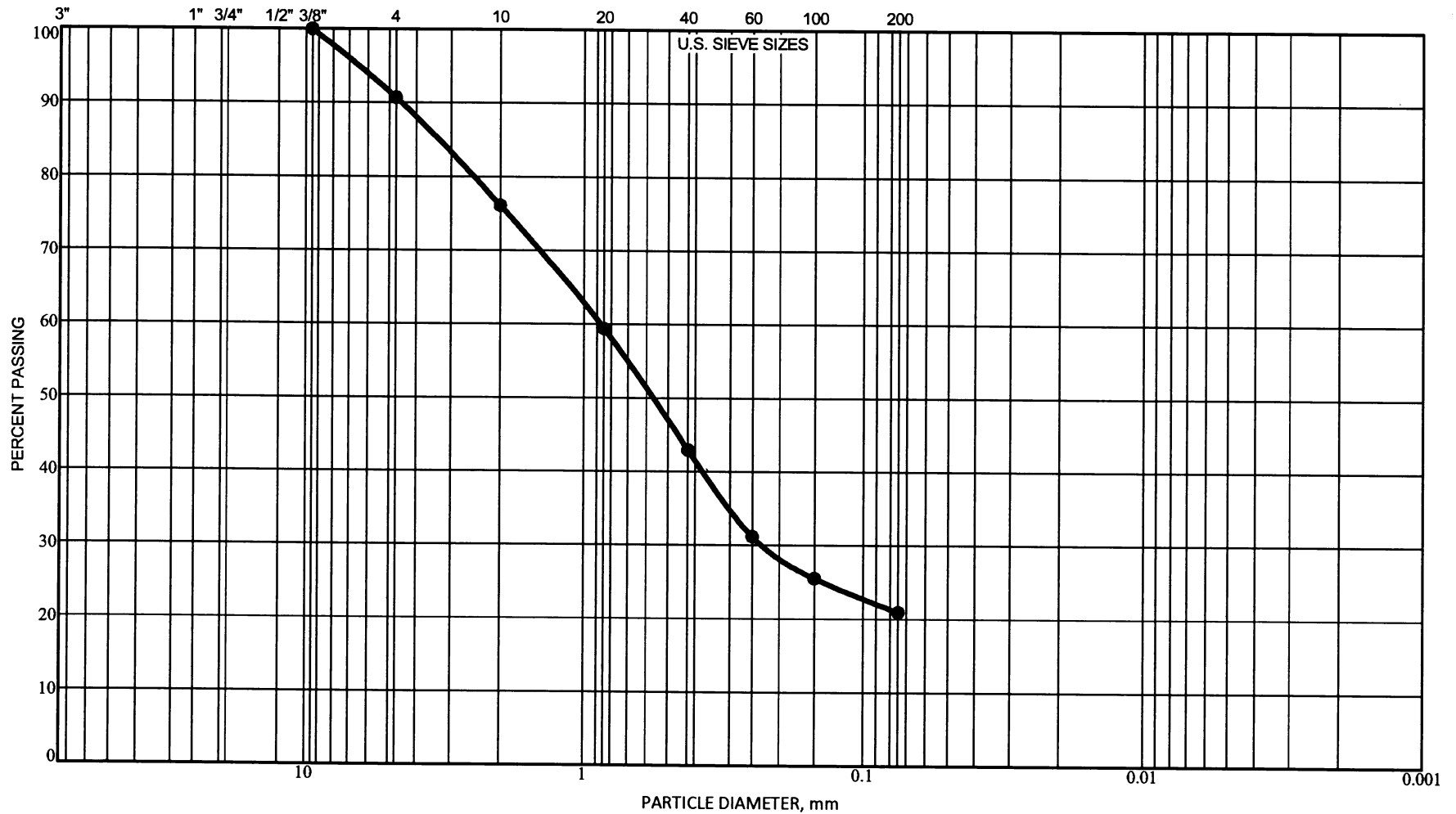
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: B-12 DEPTH: 2.5'

GRAVEL	24.2%
SAND	71.1%
FINES	4.7%

Mn/DOT Classification: SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)

GRAVEL			SAND			FINES	
COARSE	MEDIUM	FINE	COARSE	FINE		SILT	CLAY



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: B-13 DEPTH: 2.5'

GRAVEL	23.9%
SAND	55.2%
FINES	20.9%

Mn/DOT Classification: SANDY LOAM

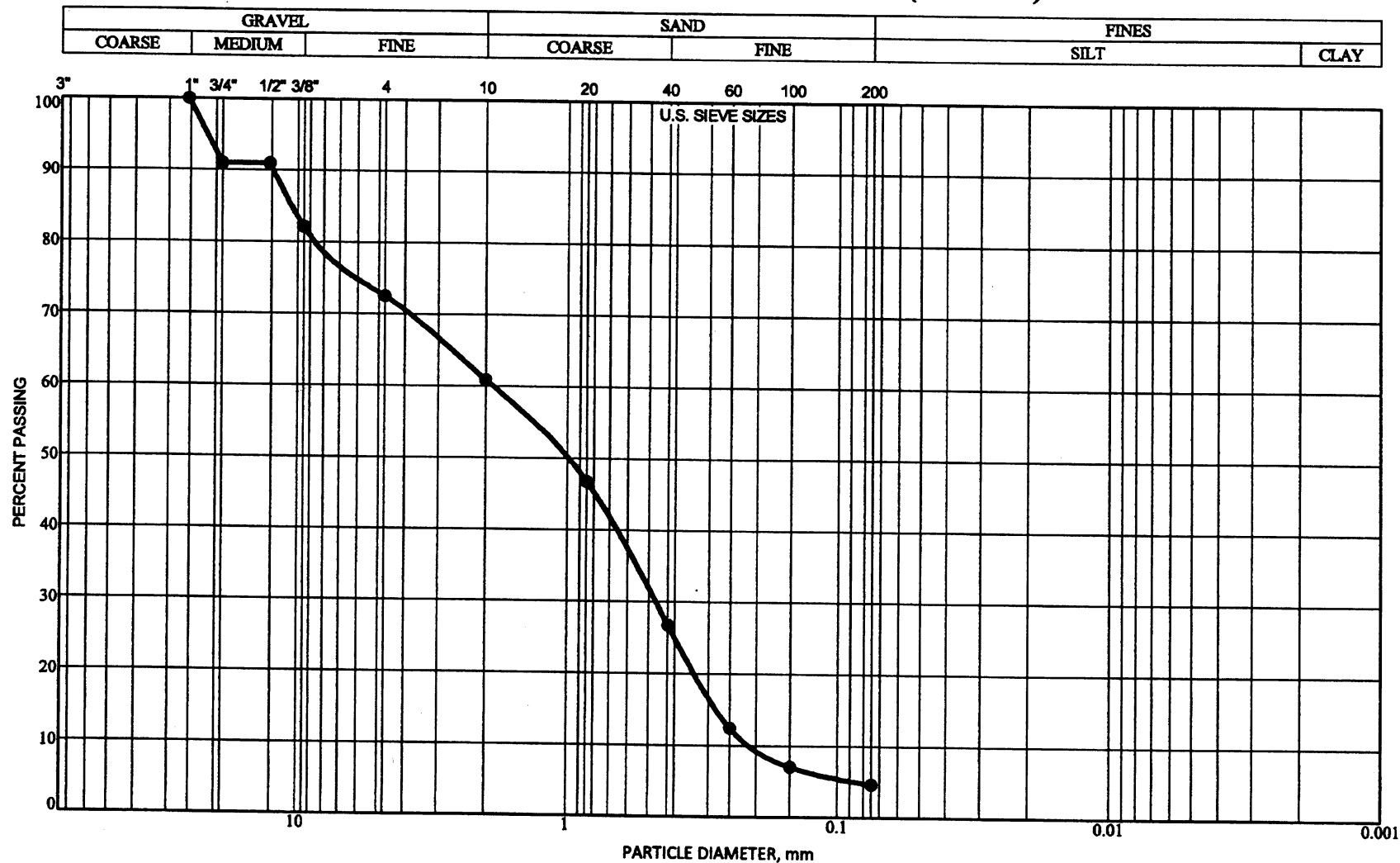
MNDOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

BL-09-00745A

Braun Intertec Corporation

M:\DOT\VERSION2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM

INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: B-14 DEPTH: 2.5'

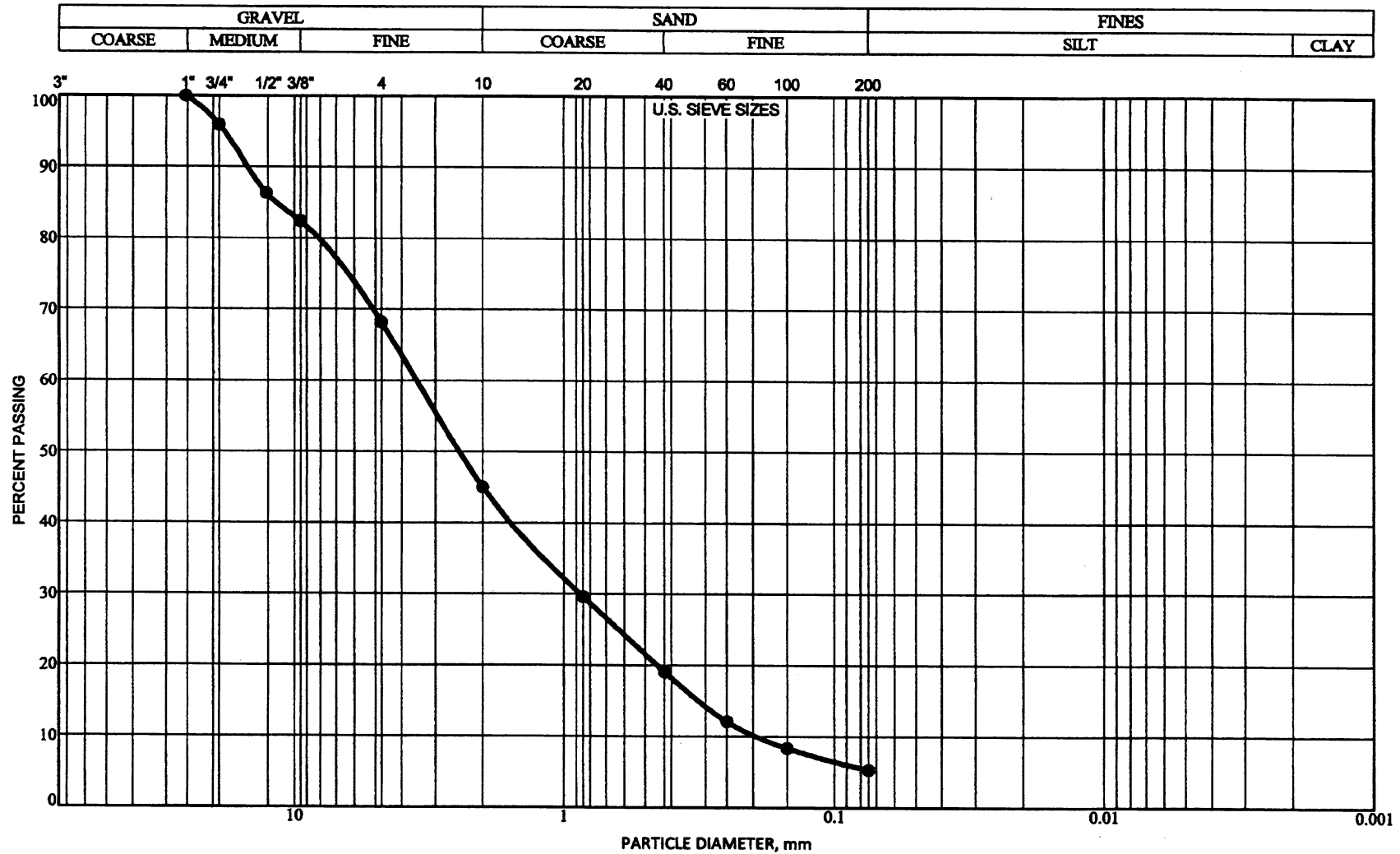
GRAVEL	39.1%
SAND	56.2%
FINES	4.7%

Mn/DOT Classification: SAND with GRAVEL

BL-09-00745A

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: E-1 DEPTH: 27.5'

GRAVEL	55.0%
SAND	39.7%
FINES	5.4%

Mn/DOT Classification: GRAVEL

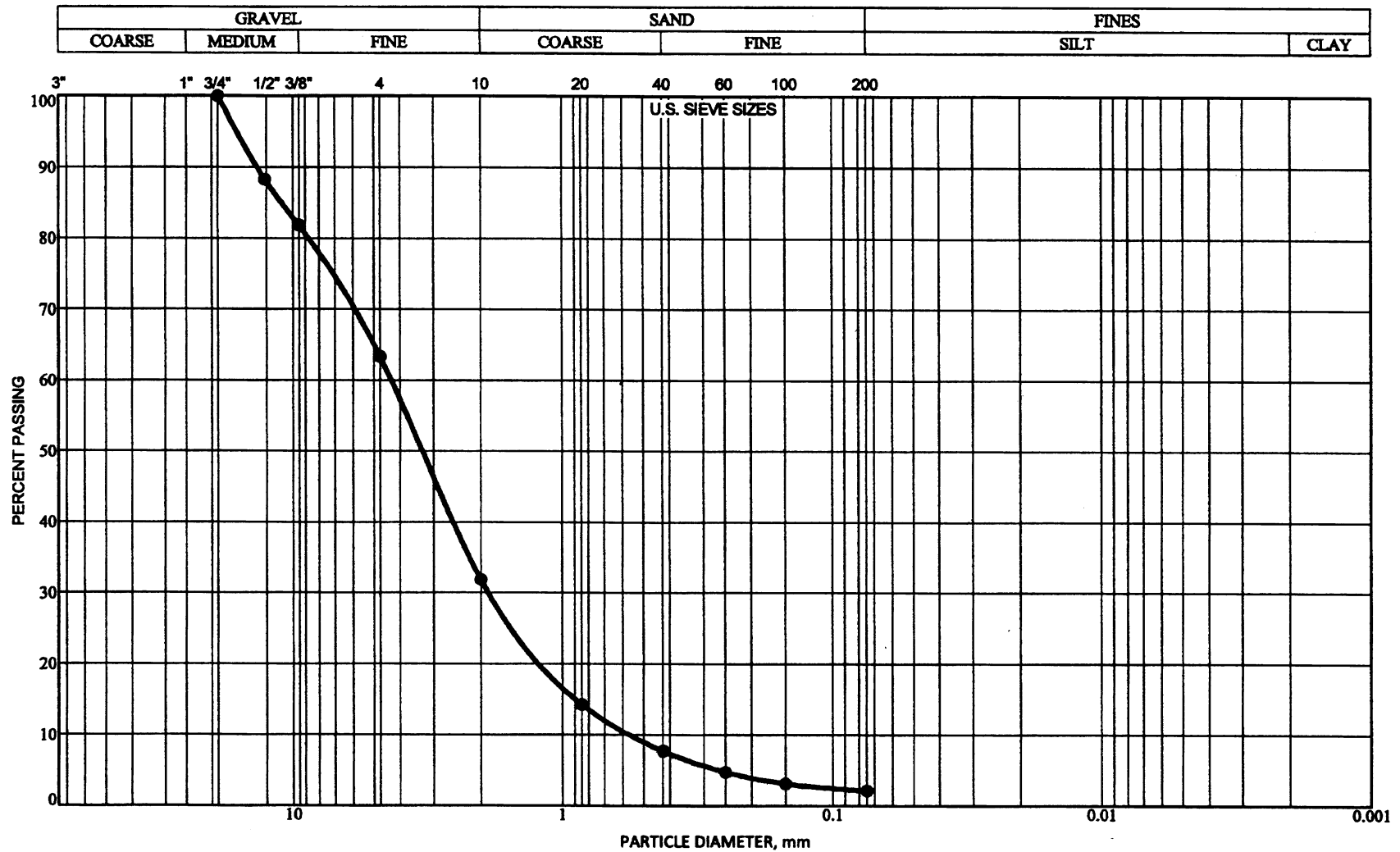
MNDOT\PERSON2\N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

BL-09-00745A

Braun Intertec Corporation

M:\DOT\VERS01\2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_VB_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: E-1 DEPTH: 32.5'

GRAVEL	68.1%
SAND	29.7%
FINES	2.2%

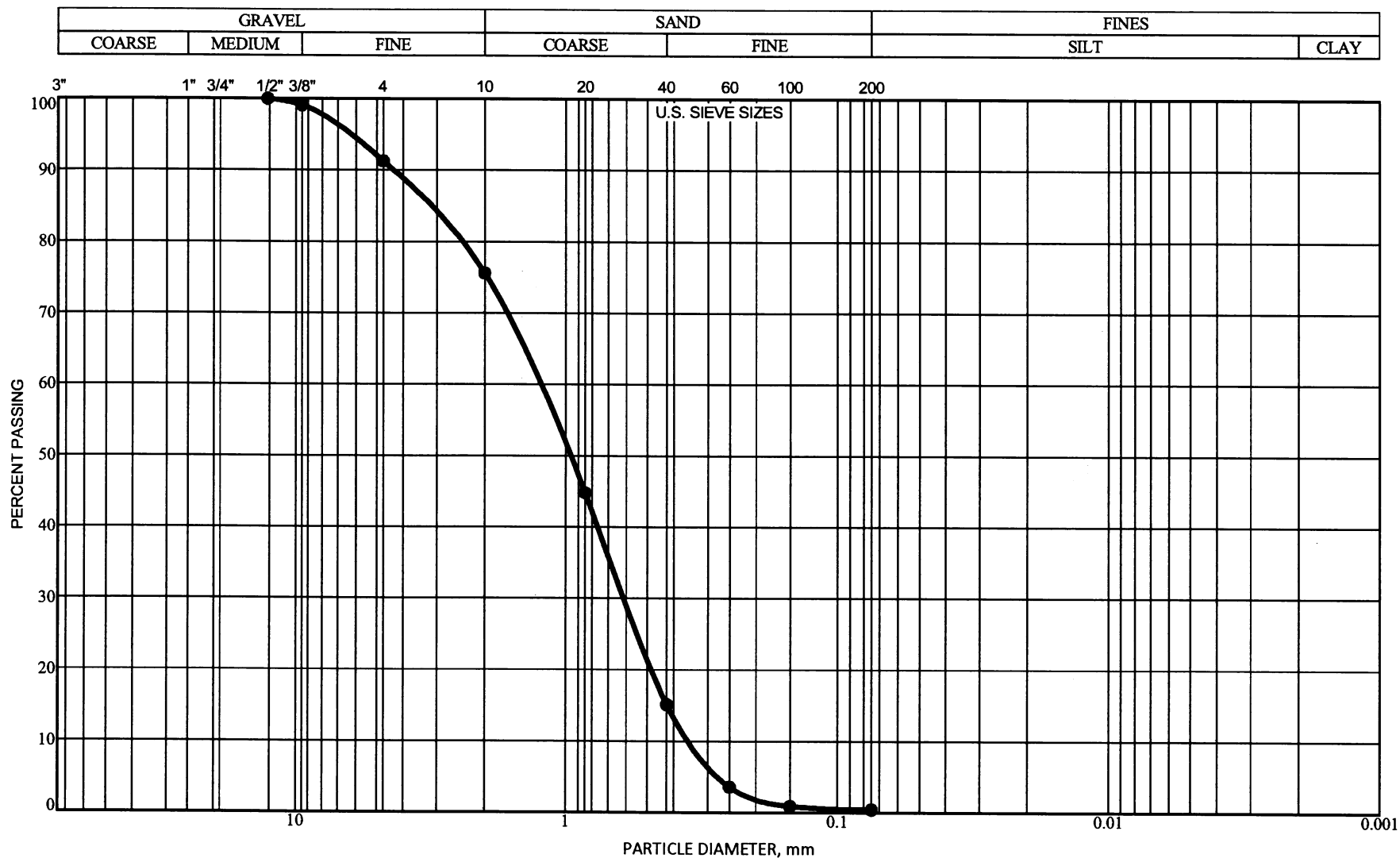
Mn/DOT Classification: GRAVEL

BL-09-00745A

Braun Intertec Corporation

MINDOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

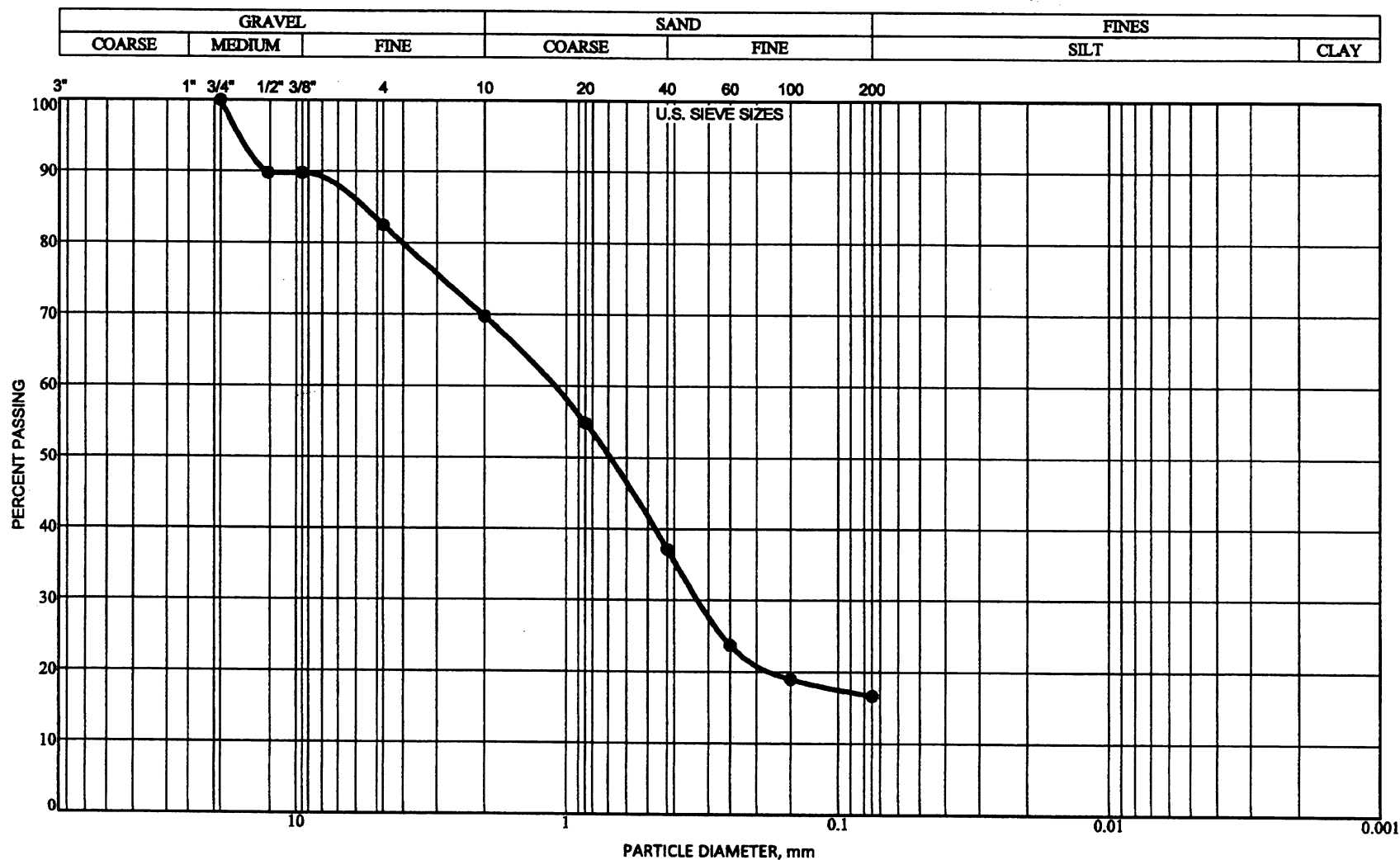
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: E-2 DEPTH: 37.5'

GRAVEL	24.4%
SAND	75.2%
FINES	0.4%

Mn/DOT Classification: SAND

MNDOT\SOIN2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/28/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM

INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: E-3 DEPTH: 2.5'

GRAVEL	30.2%
SAND	53.1%
FINES	16.7%

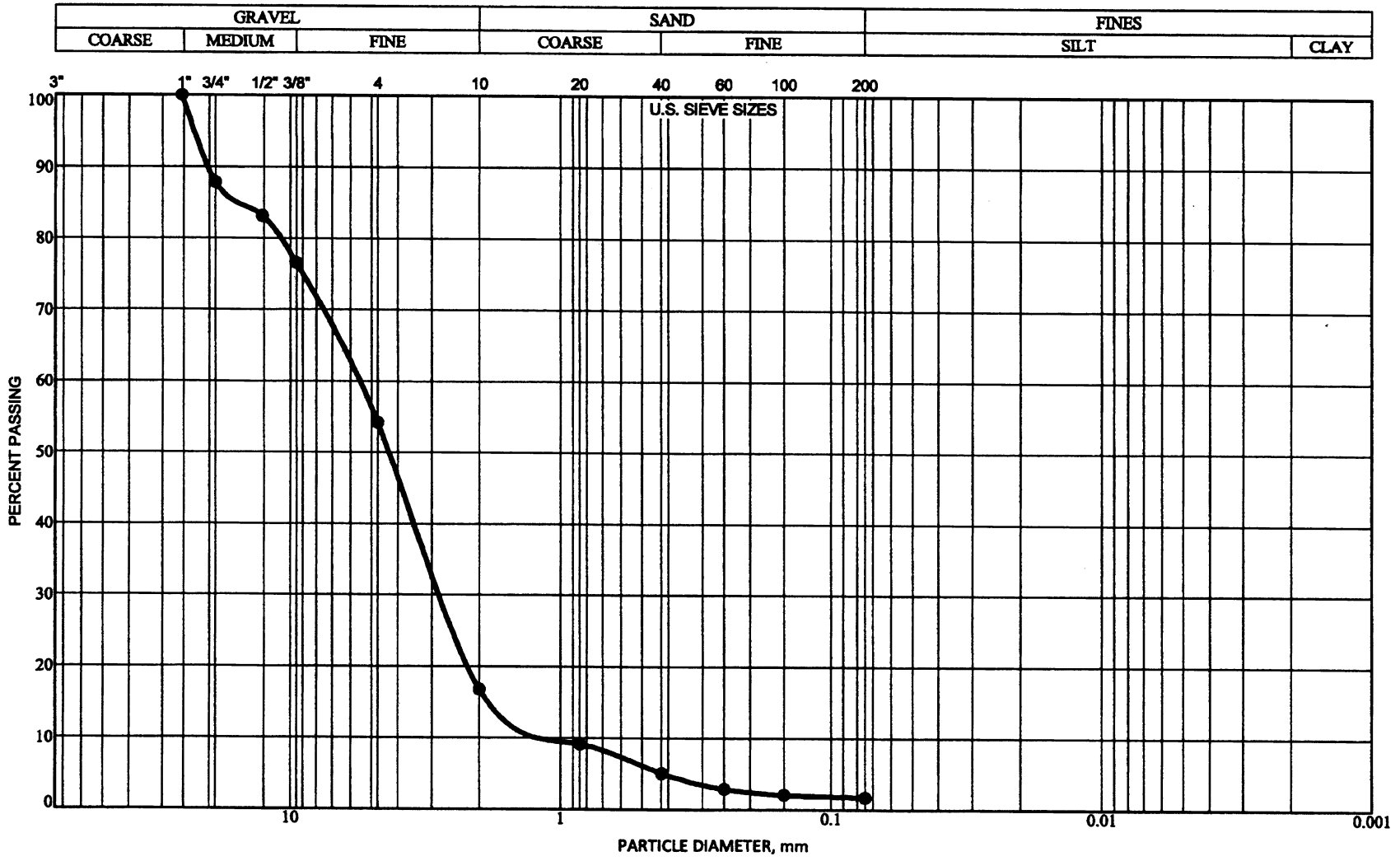
Mn/DOT Classification: Loamy SAND
with GRAVEL

BL-09-00745A

Braun Intertec Corporation

M:\DOT\PERSON2 N:\GINT\PROJECTS\X-GEO\AB11-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



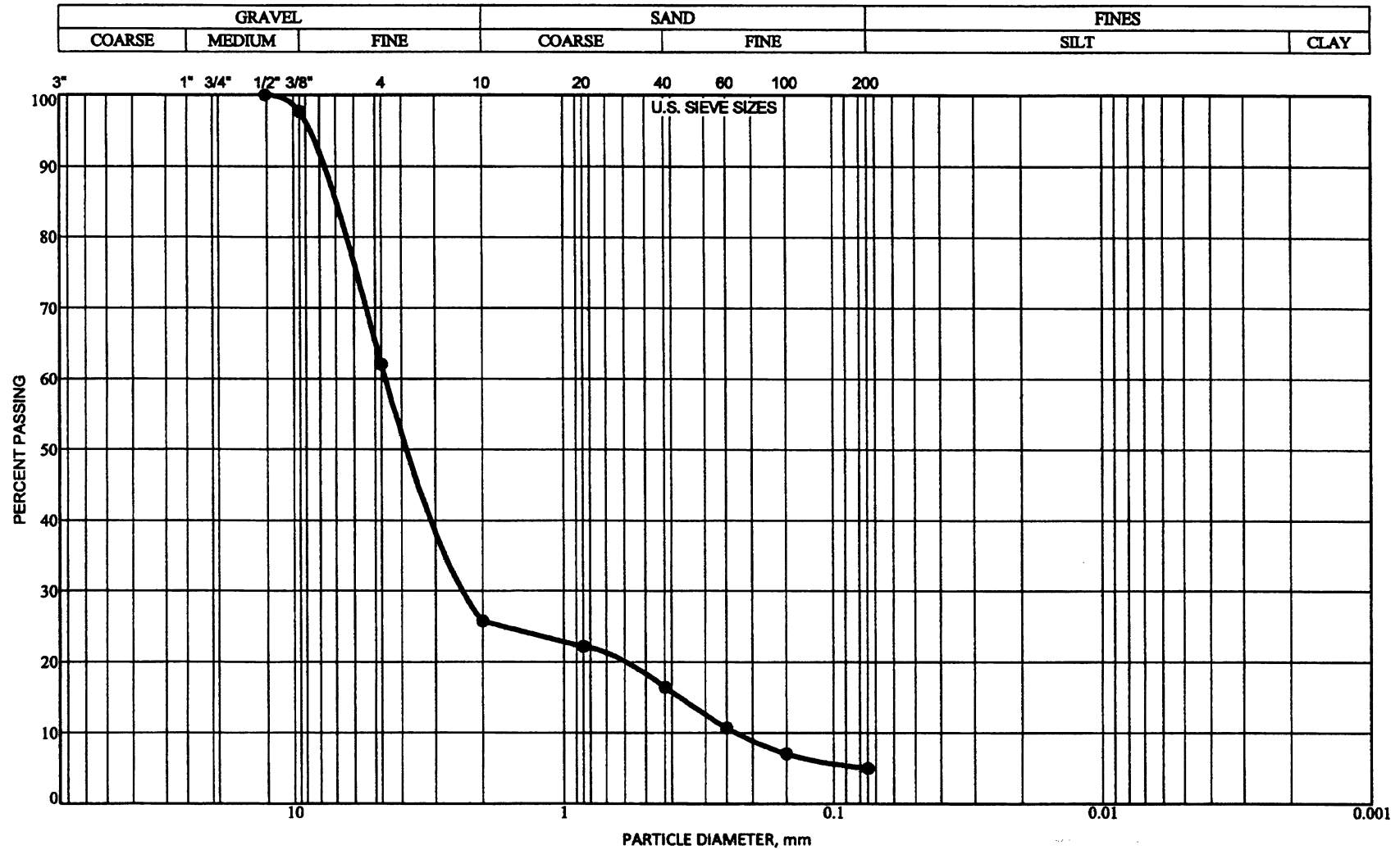
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: E-4 DEPTH: 15.0'

GRAVEL	83.2%
SAND	15.1%
FINES	1.7%

Mn/DOT Classification: GRAVEL

MINDOT\PERSON2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: E-4 DEPTH: 37.5'

GRAVEL	74.2%
SAND	20.7%
FINES	5.1%

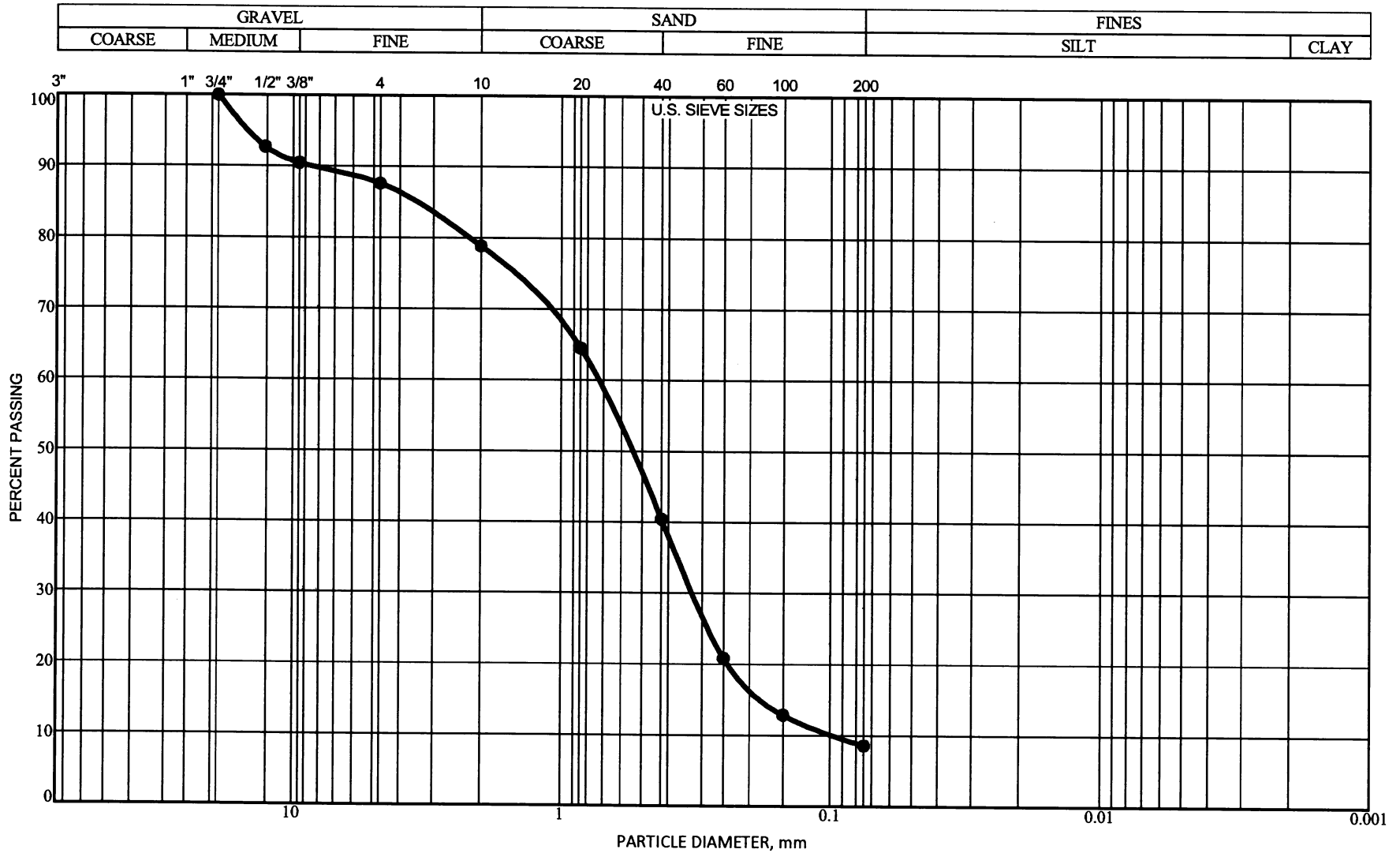
Mn/DOT Classification: GRAVEL

BL-09-00745A

Braun Intertec Corporation

MNDOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

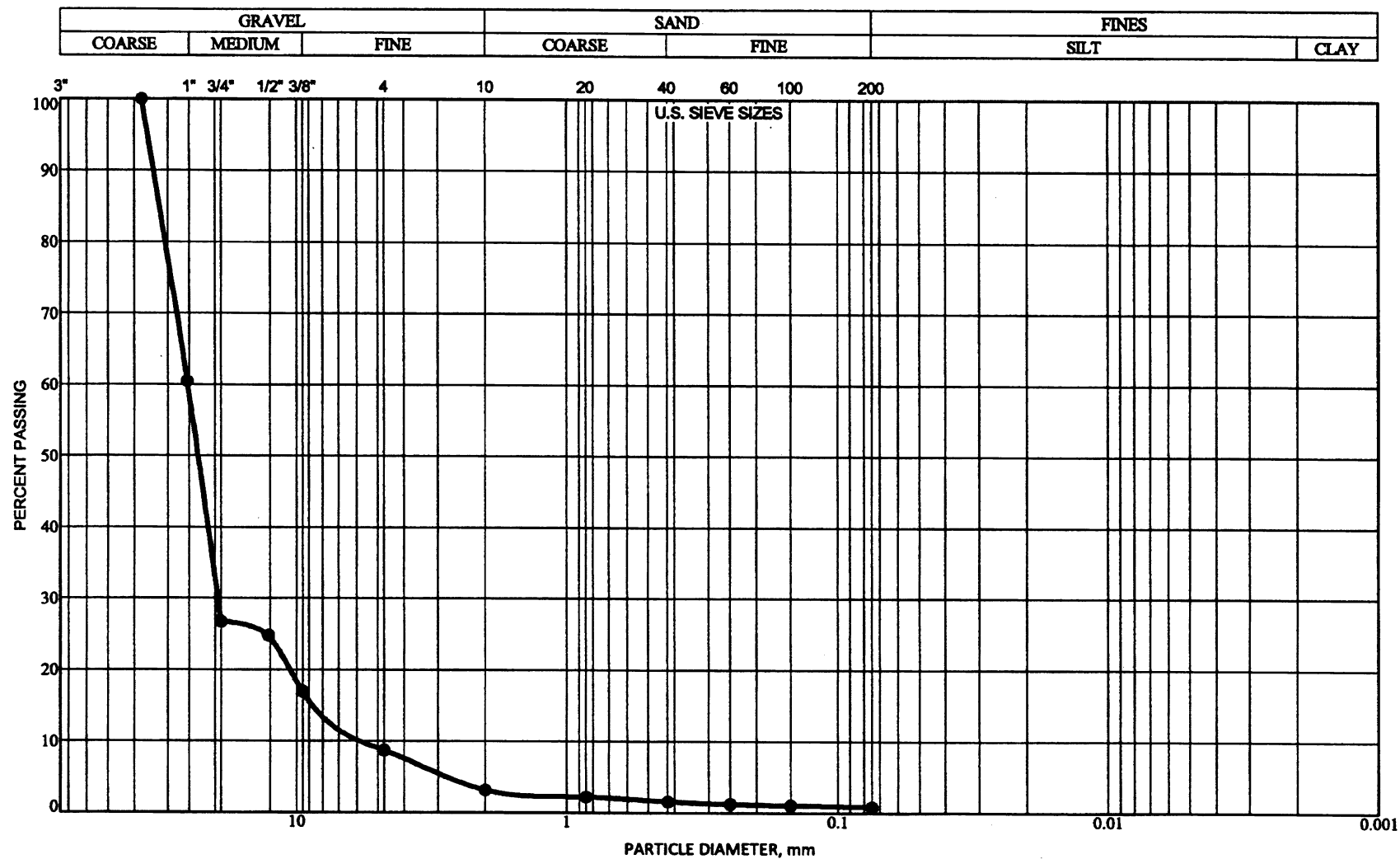
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: E-5 DEPTH: 17.5'

GRAVEL	21.2%
SAND	70.3%
FINES	8.6%

Mn/DOT Classification: SAND

M:\DOT\PERSON2 N:\GINT\PROJECTS\VE\GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: E-5 DEPTH: 27.5'

GRAVEL	96.8%
SAND	2.4%
FINES	0.8%

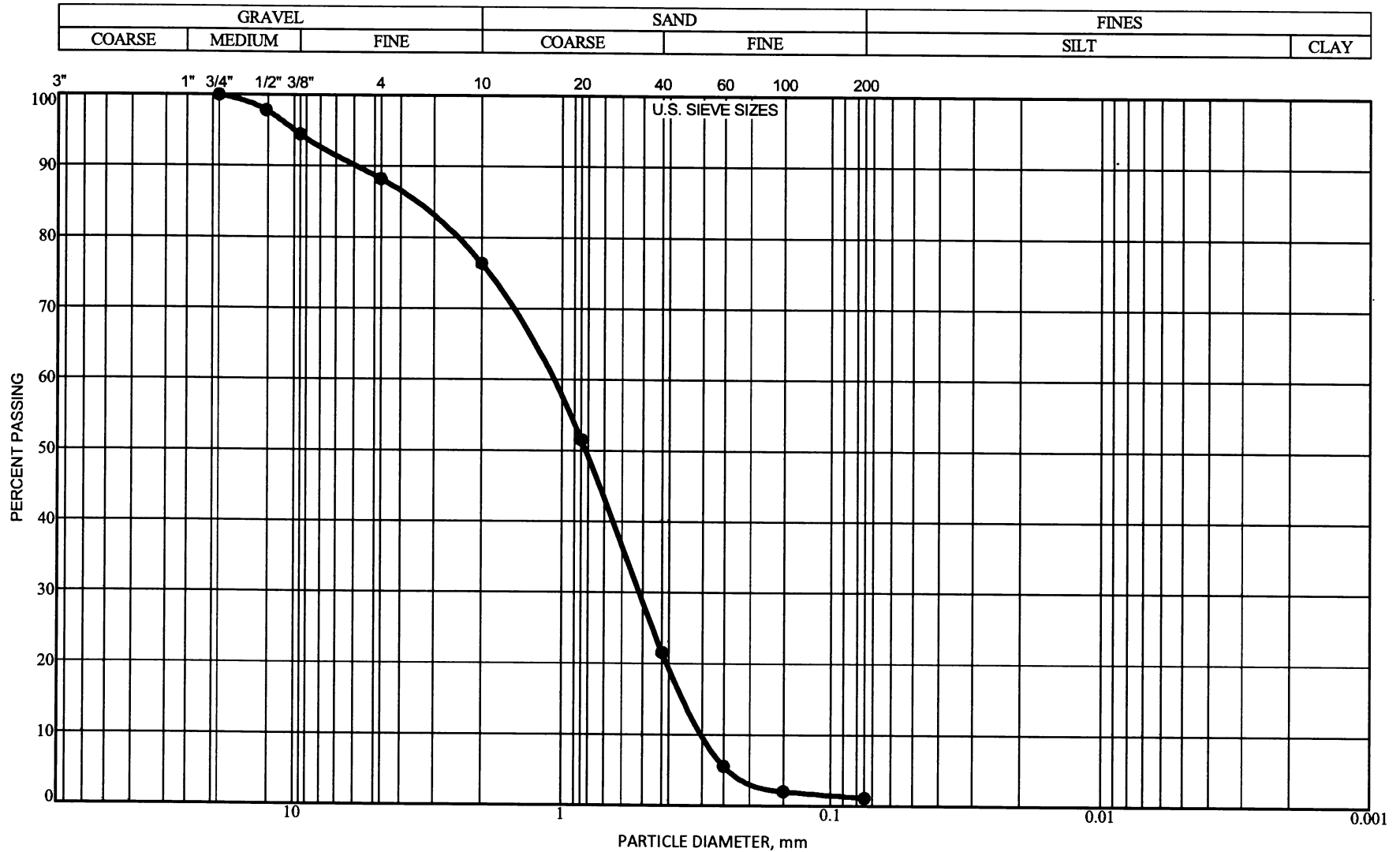
Mn/DOT Classification: GRAVEL

BL-09-00745A

Braun Intertec Corporation

MNDOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

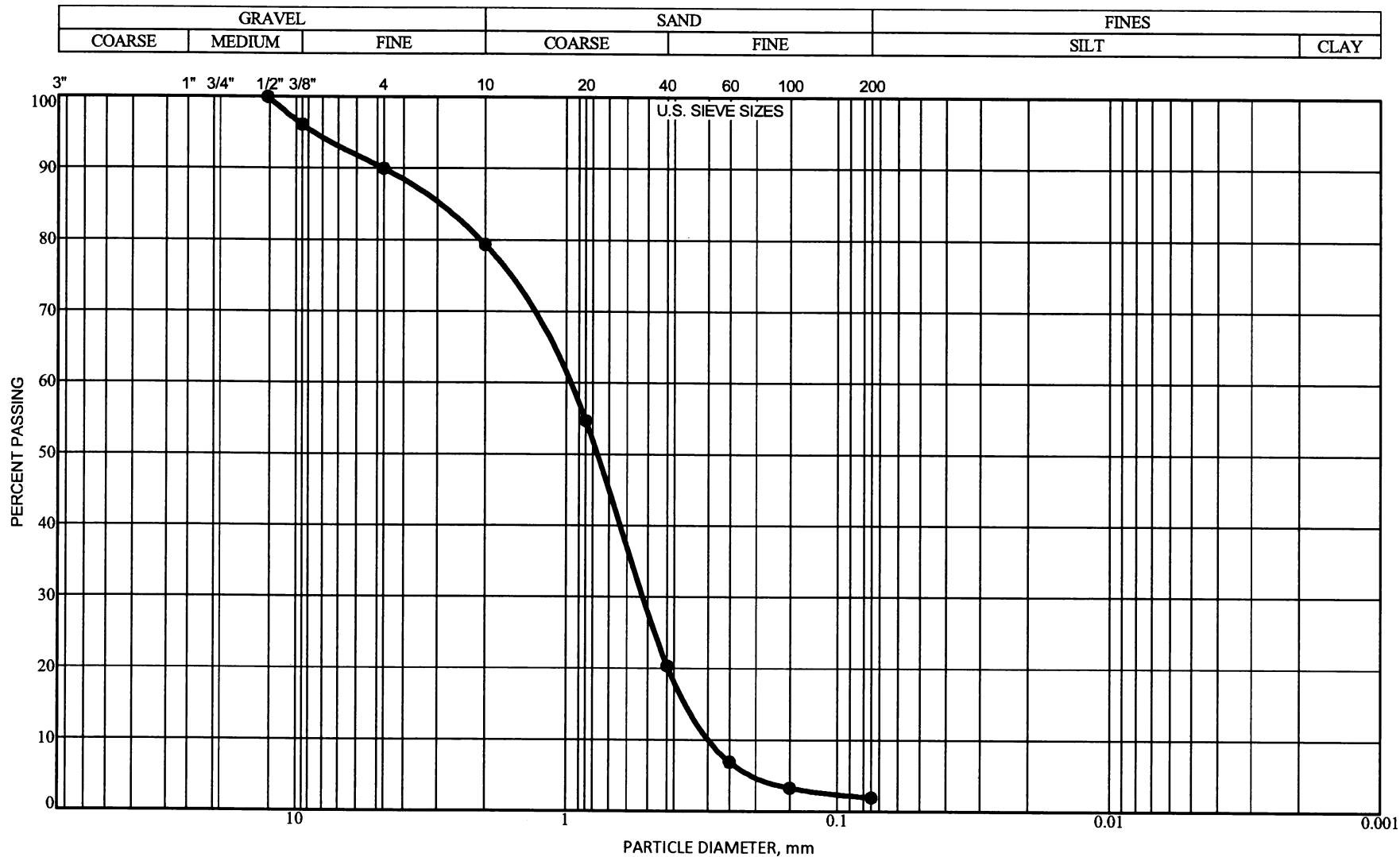
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-1 DEPTH: 30.0'

GRAVEL	23.6%
SAND	75.2%
FINES	1.1%

Mn/DOT Classification: SAND

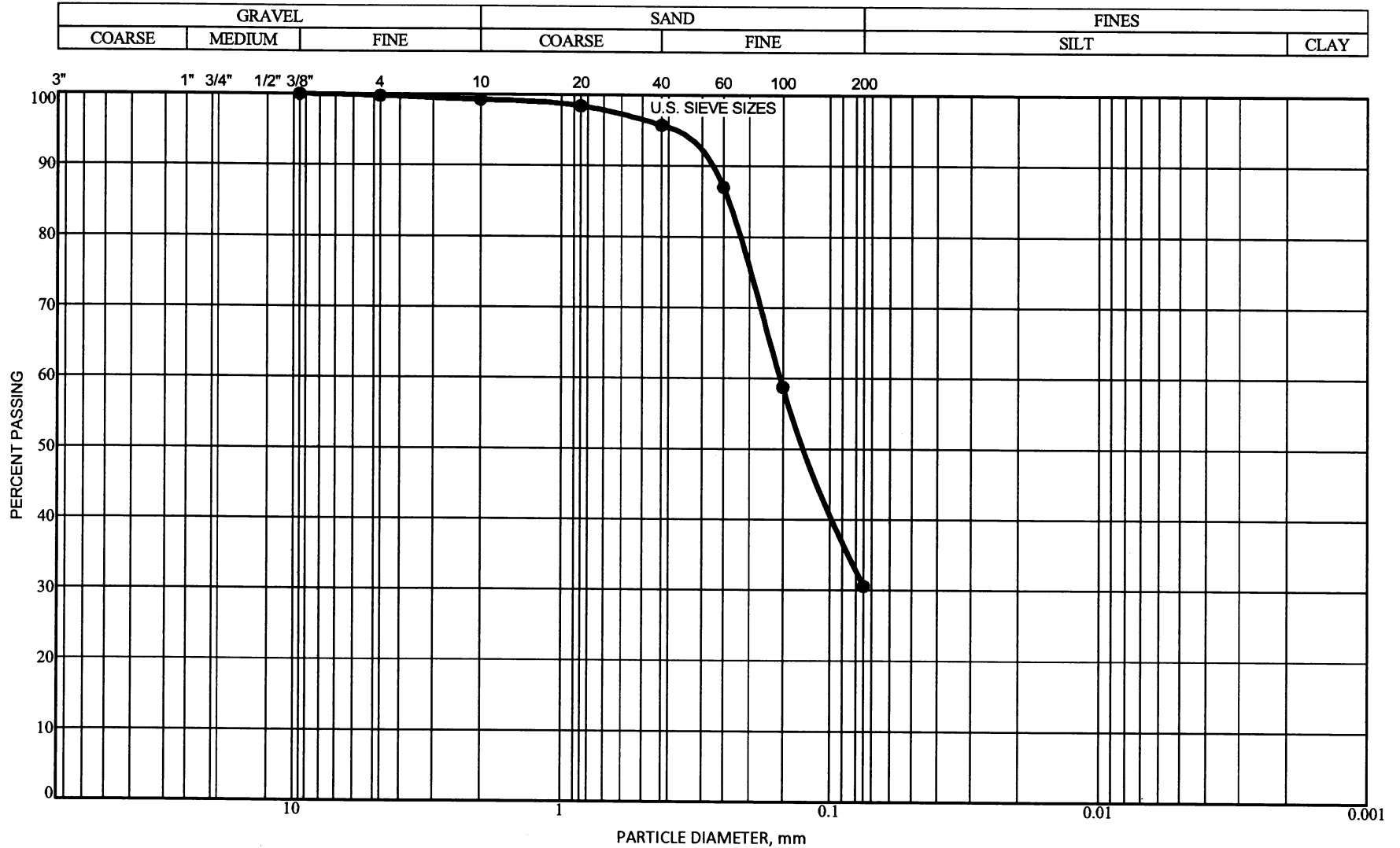
MINDOTVERSION2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



MINDOTVERSION2 N:\GINT\PROJECTS\K-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

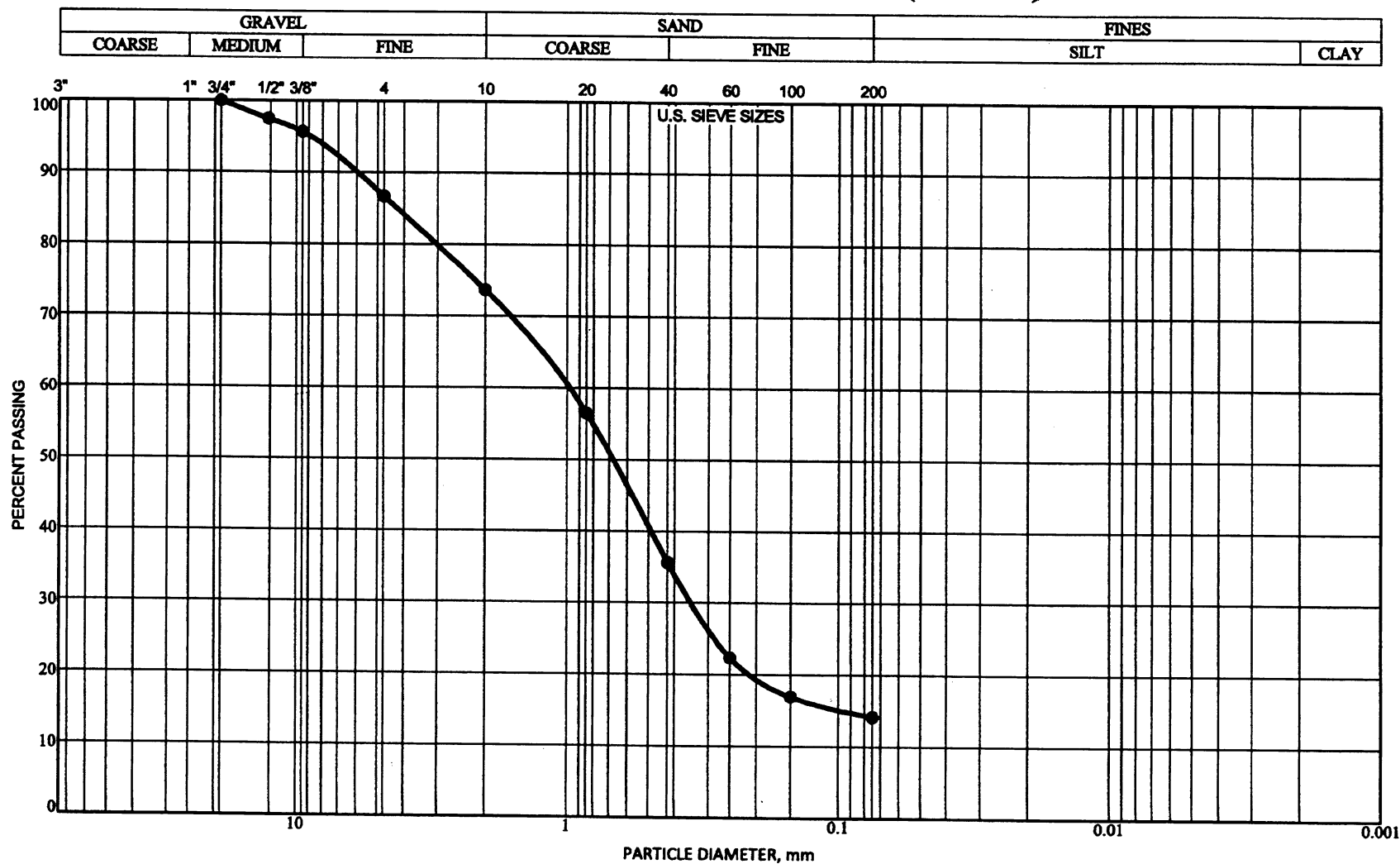
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-1 DEPTH: 60.0'

GRAVEL	0.7%
SAND	68.7%
FINES	30.6%

Mn/DOT Classification: SANDY LOAM

MANDOTVERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/28/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-2 DEPTH: 2.5'

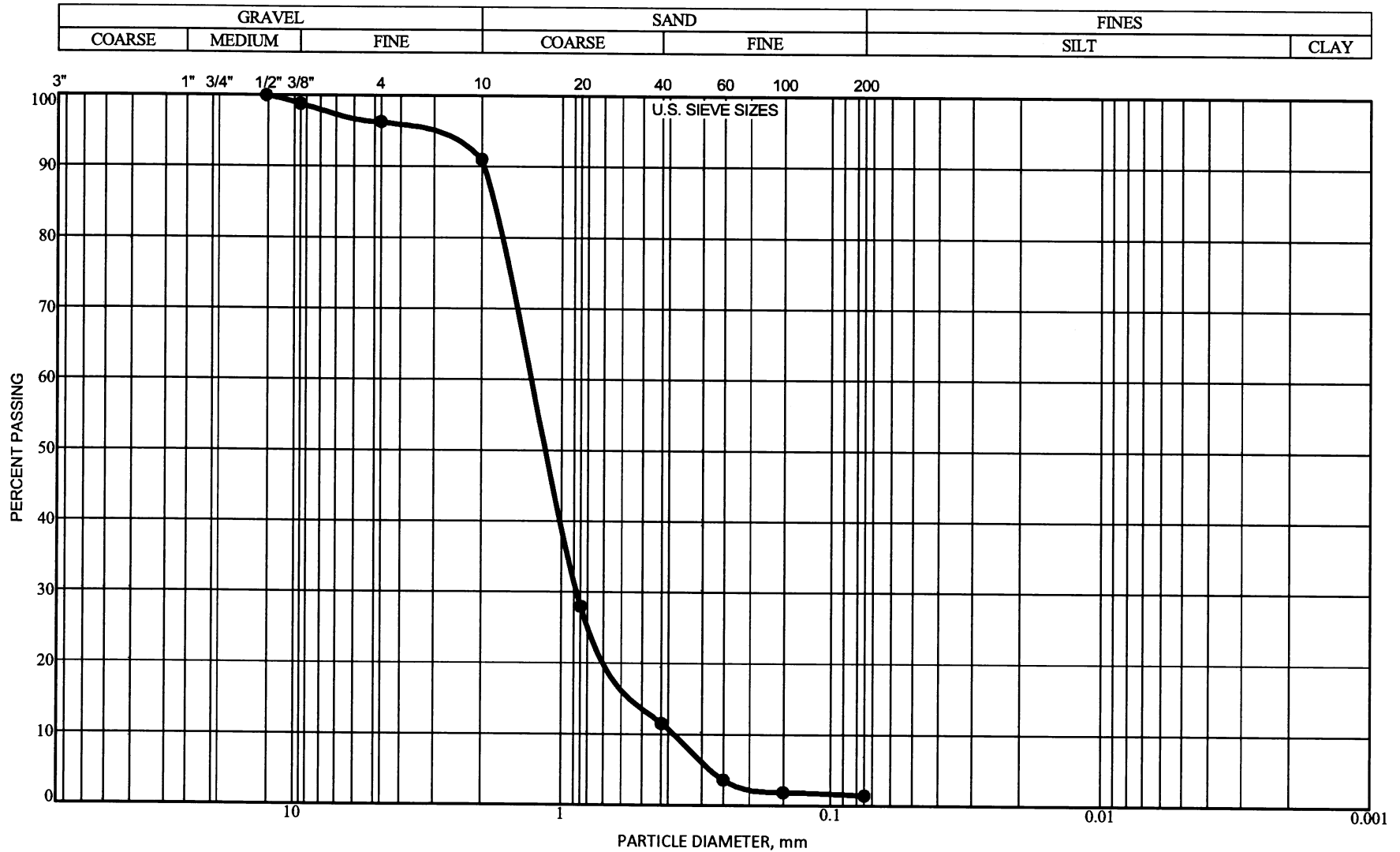
GRAVEL	26.3%
SAND	59.5%
FINES	14.2%

Mn/DOT Classification: Loamy SAND
with GRAVEL

BL-09-00745A

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-2 DEPTH: 35.0'

GRAVEL	9.0%
SAND	89.6%
FINES	1.4%

Mn/DOT Classification: SAND

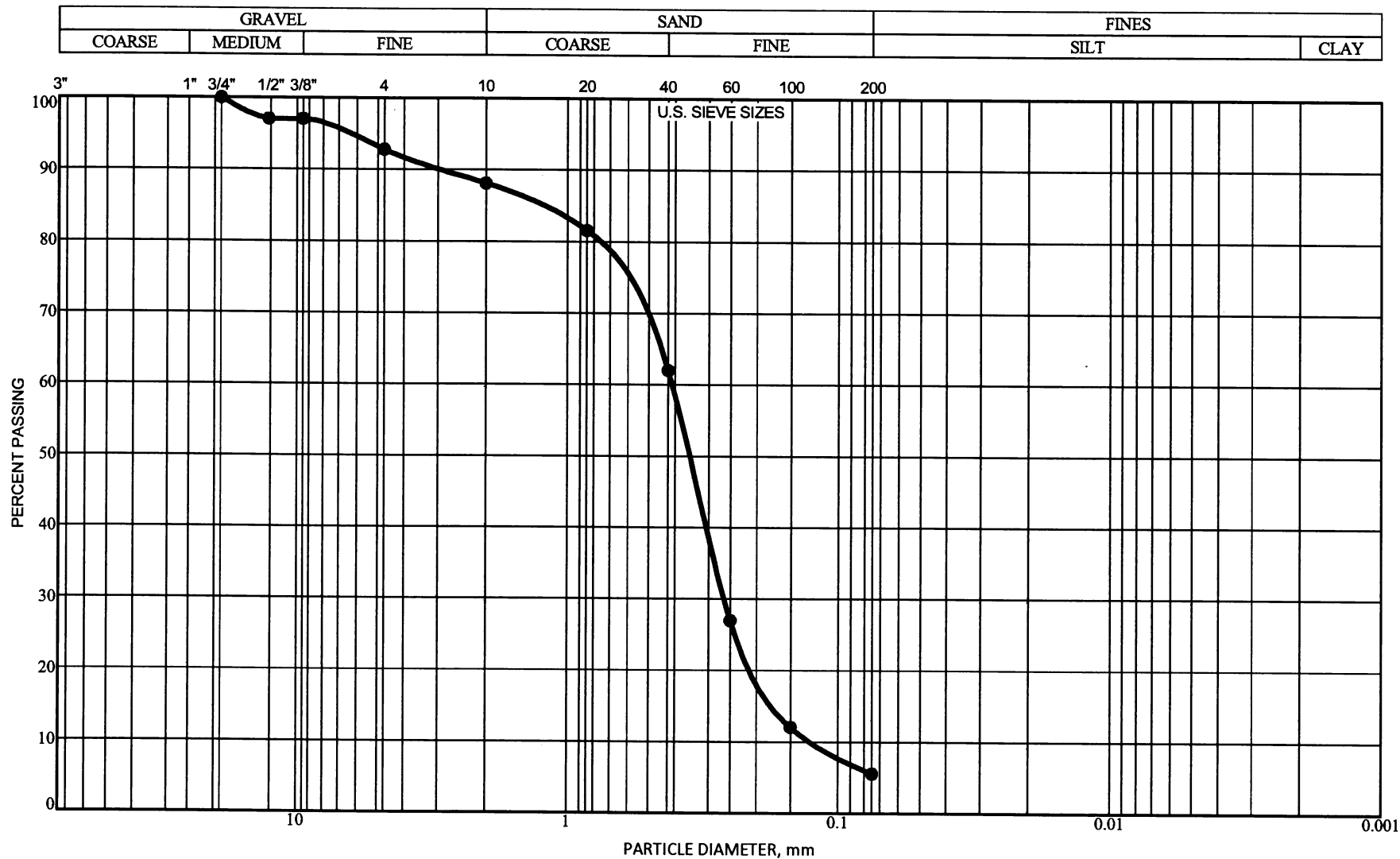
MNDOT\VERSION2 N:\GINT\PROJECTS\GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

BL-09-00745A

Braun Intertec Corporation

MINDOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



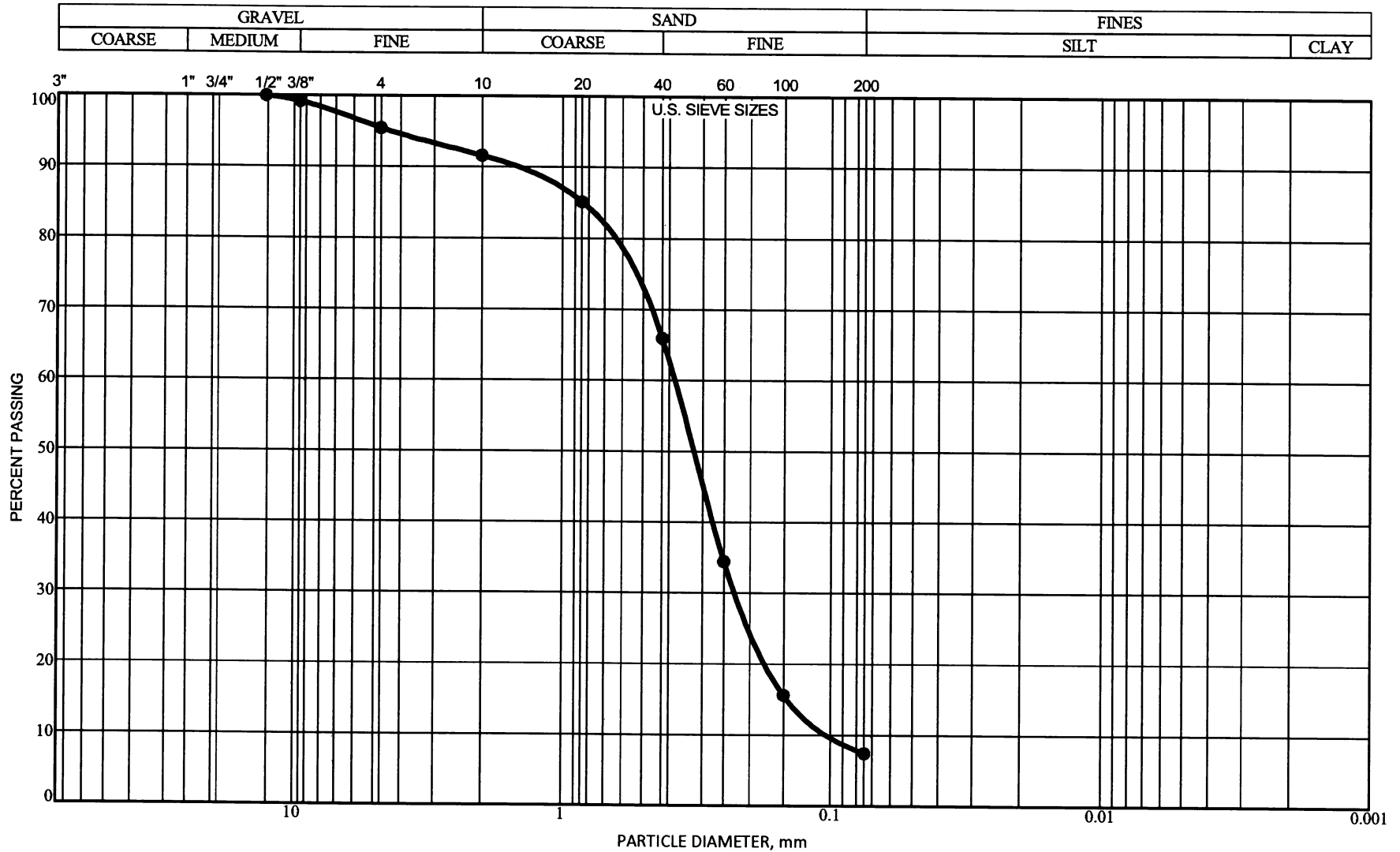
BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-2 DEPTH: 60.0'

GRAVEL	11.9%
SAND	82.6%
FINES	5.6%

Mn/DOT Classification: SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



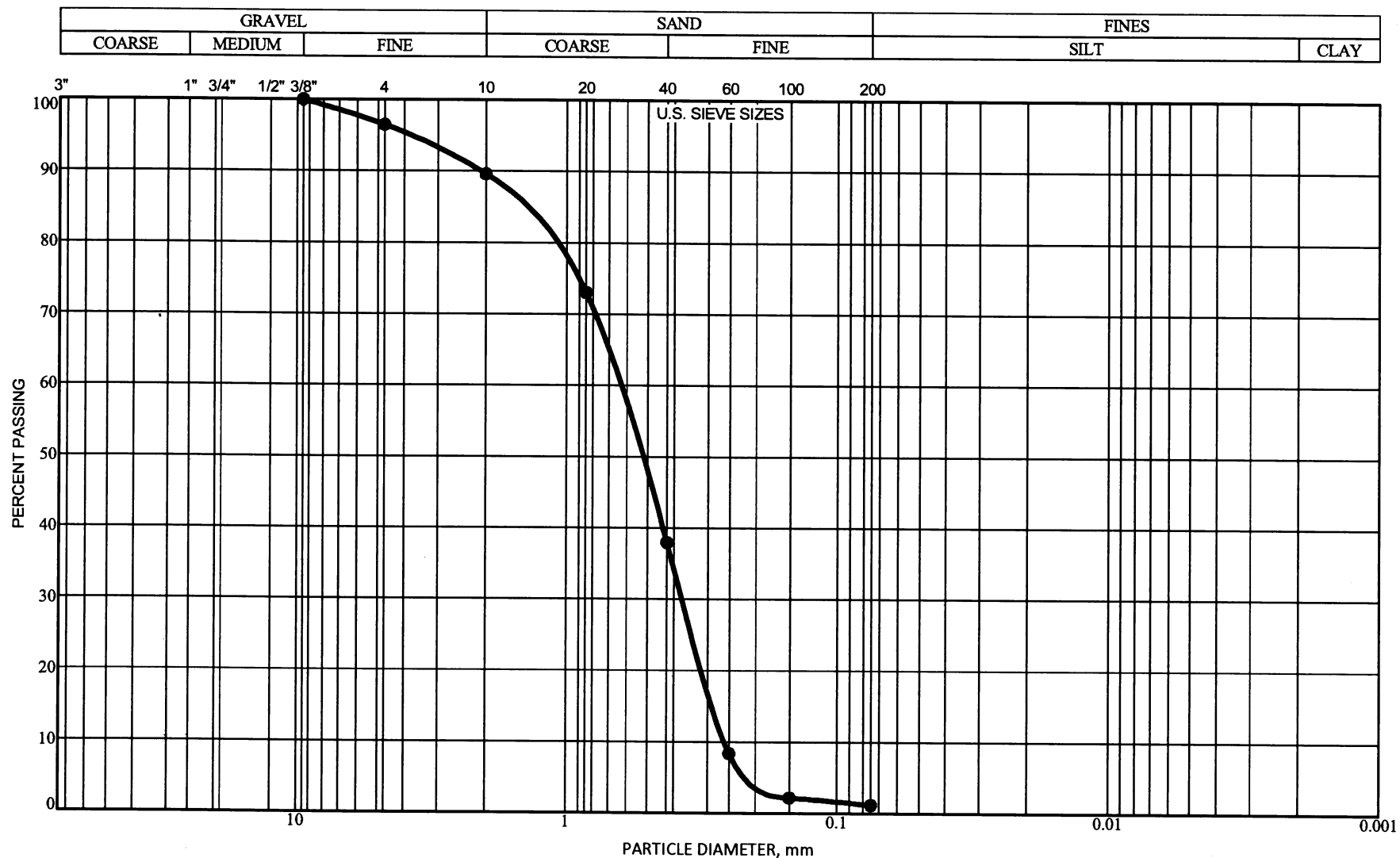
BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-2 DEPTH: 70.0'

GRAVEL	8.4%
SAND	84.2%
FINES	7.4%

Mn/DOT Classification: SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

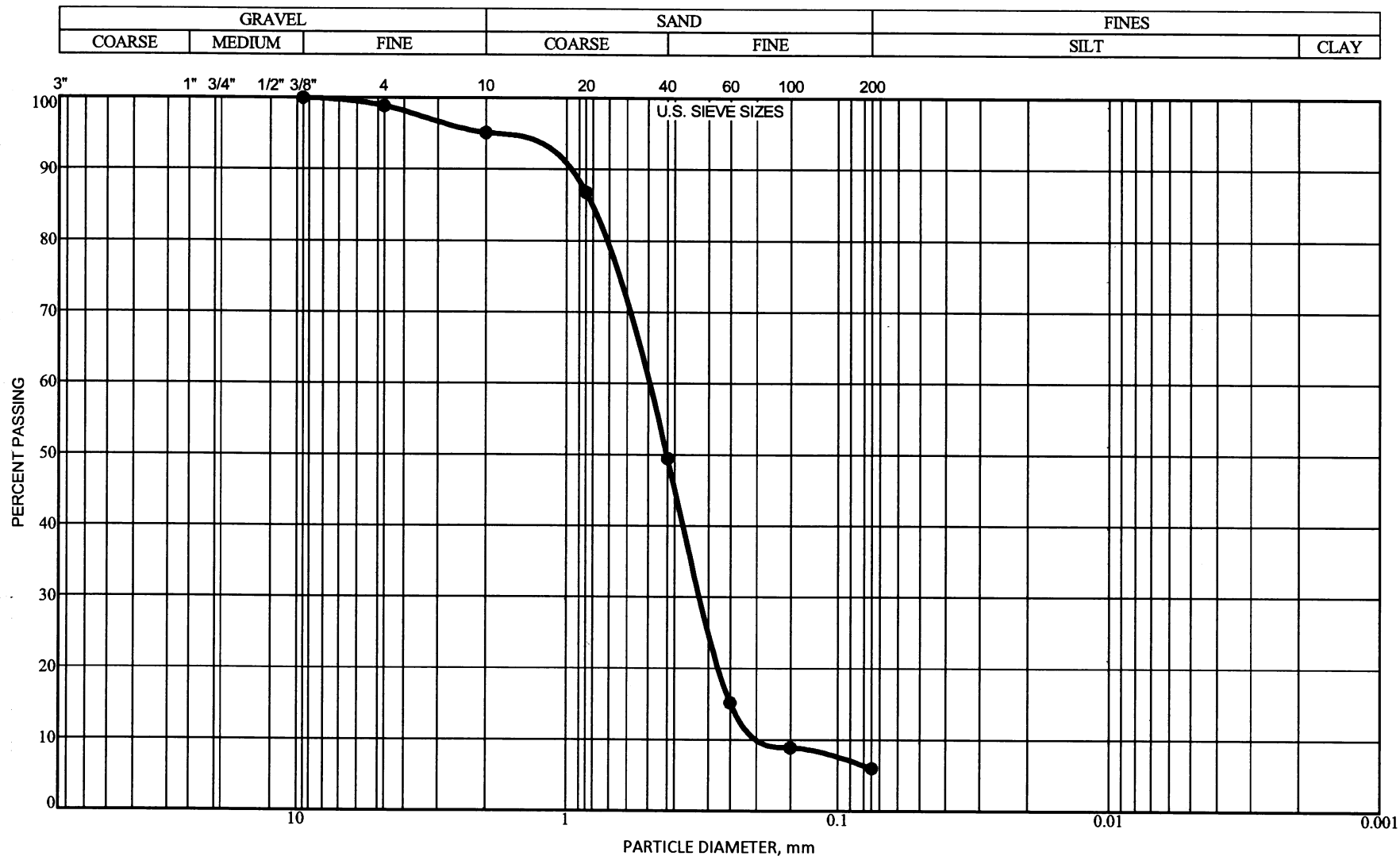
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-3 DEPTH: 35.0'

GRAVEL	10.4%
SAND	88.4%
FINES	1.2%

Mn/DOT Classification: SAND

MINDOTVERSION2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\WINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

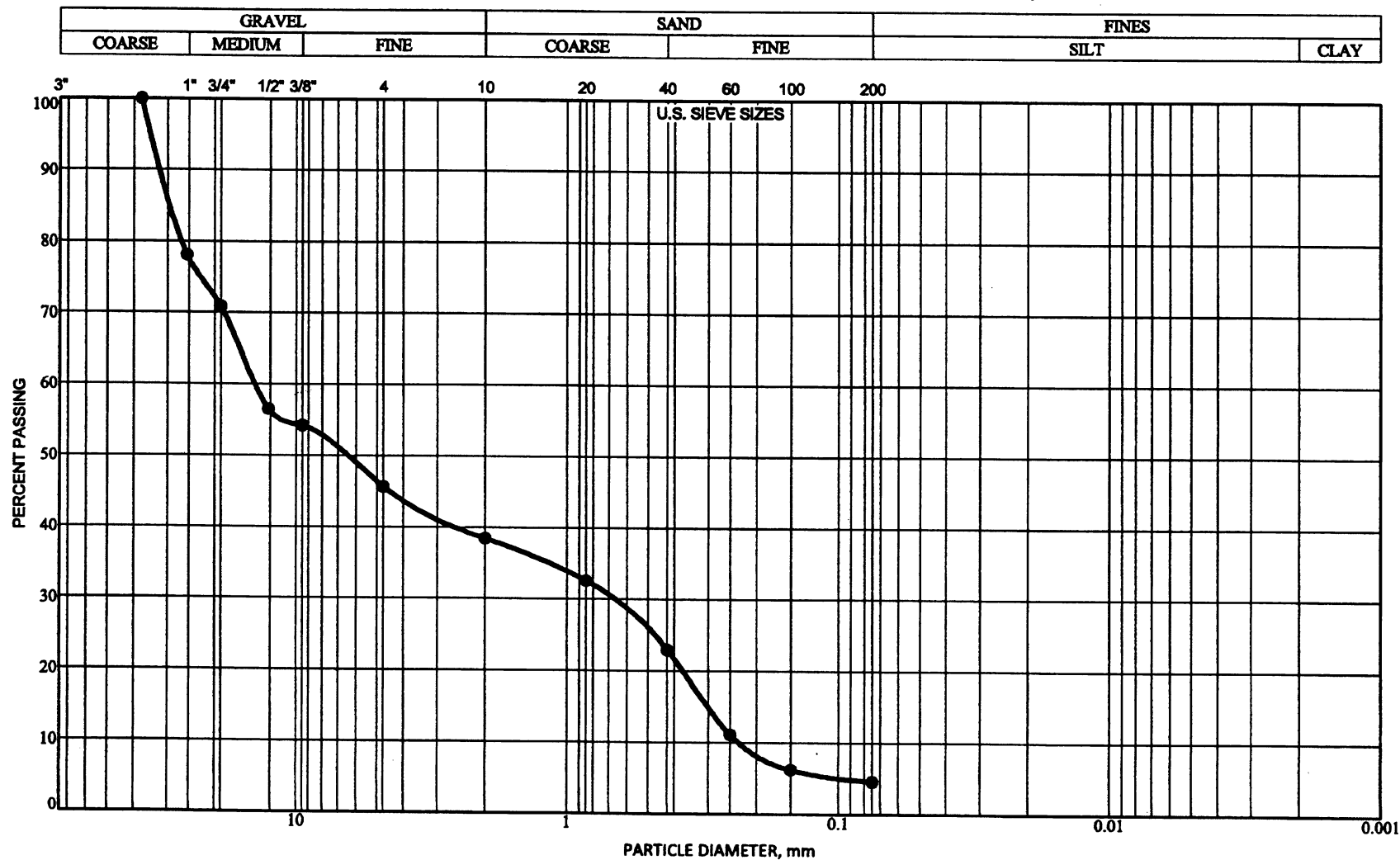
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-3 DEPTH: 50.0'

GRAVEL	4.9%
SAND	89.1%
FINES	6.0%

Mn/DOT Classification: SAND

N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-4 DEPTH: 35.0'

GRAVEL	61.6%
SAND	33.9%
FINES	4.5%

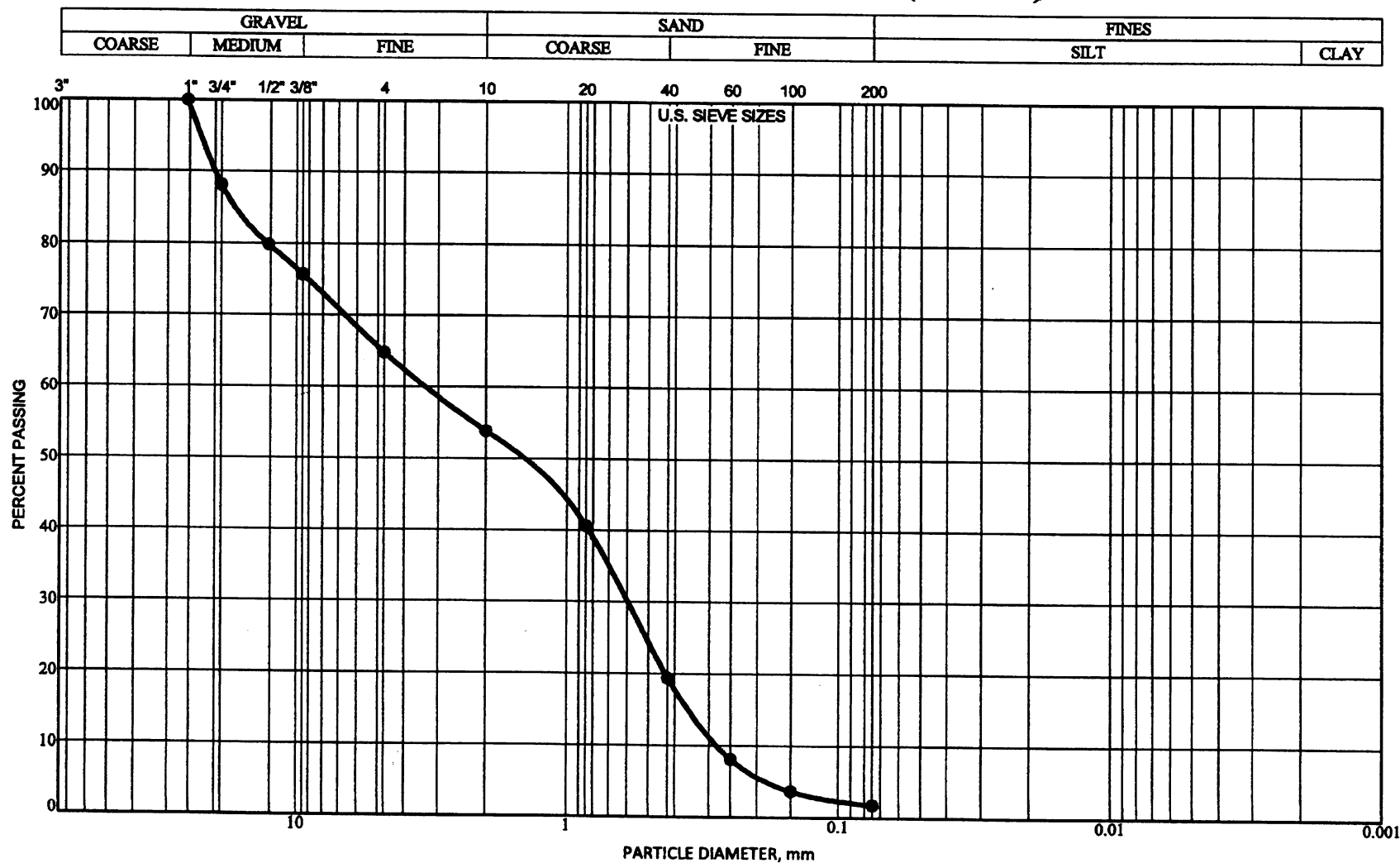
Mn/DOT Classification: GRAVEL

BL-09-00745A

Braun Intertec Corporation

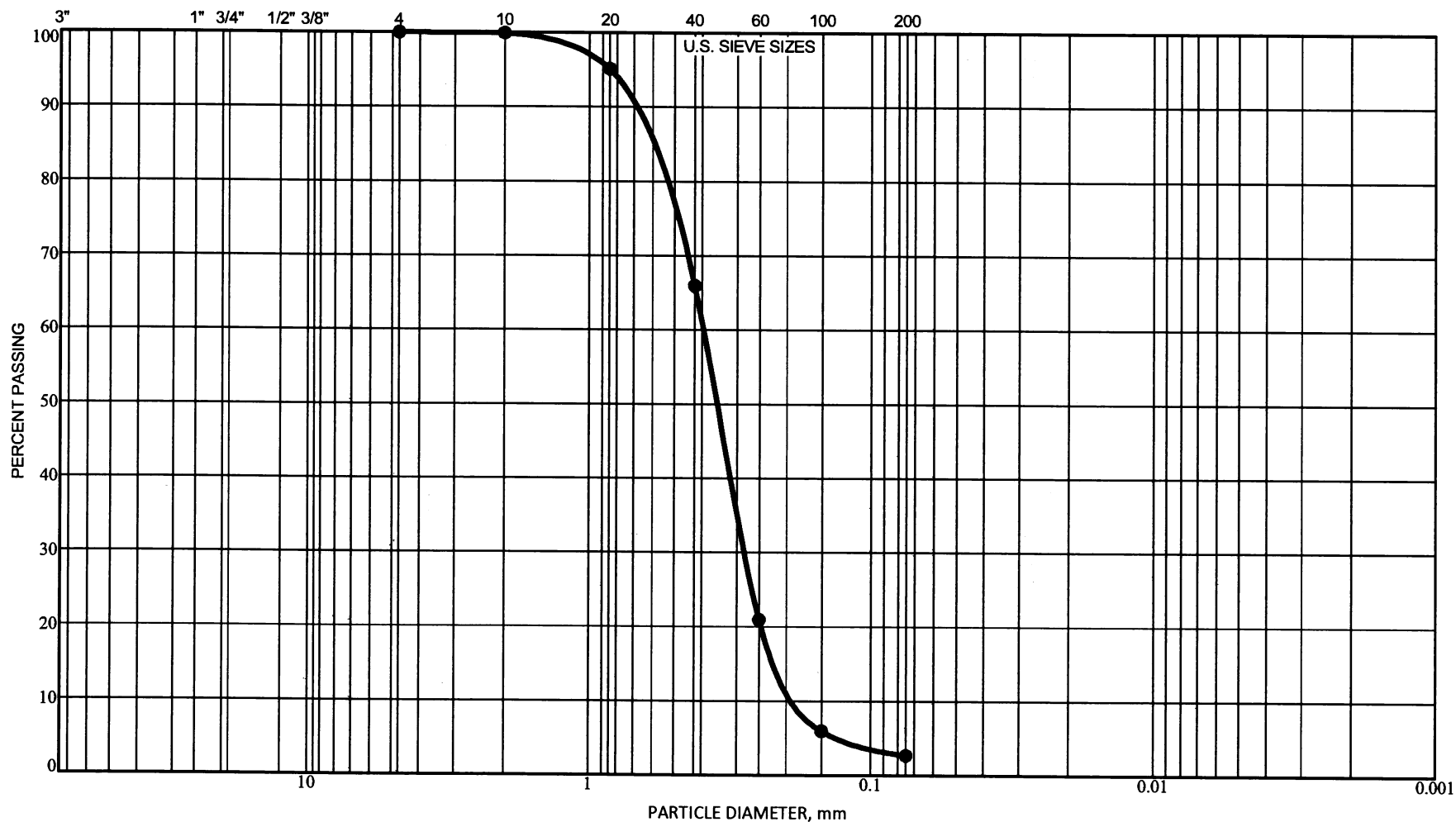
M:\DOT\SOIN2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)

GRAVEL			SAND			FINES	
COARSE	MEDIUM	FINE	COARSE	FINE		SILT	CLAY



BRAUNSM
INTERTEC

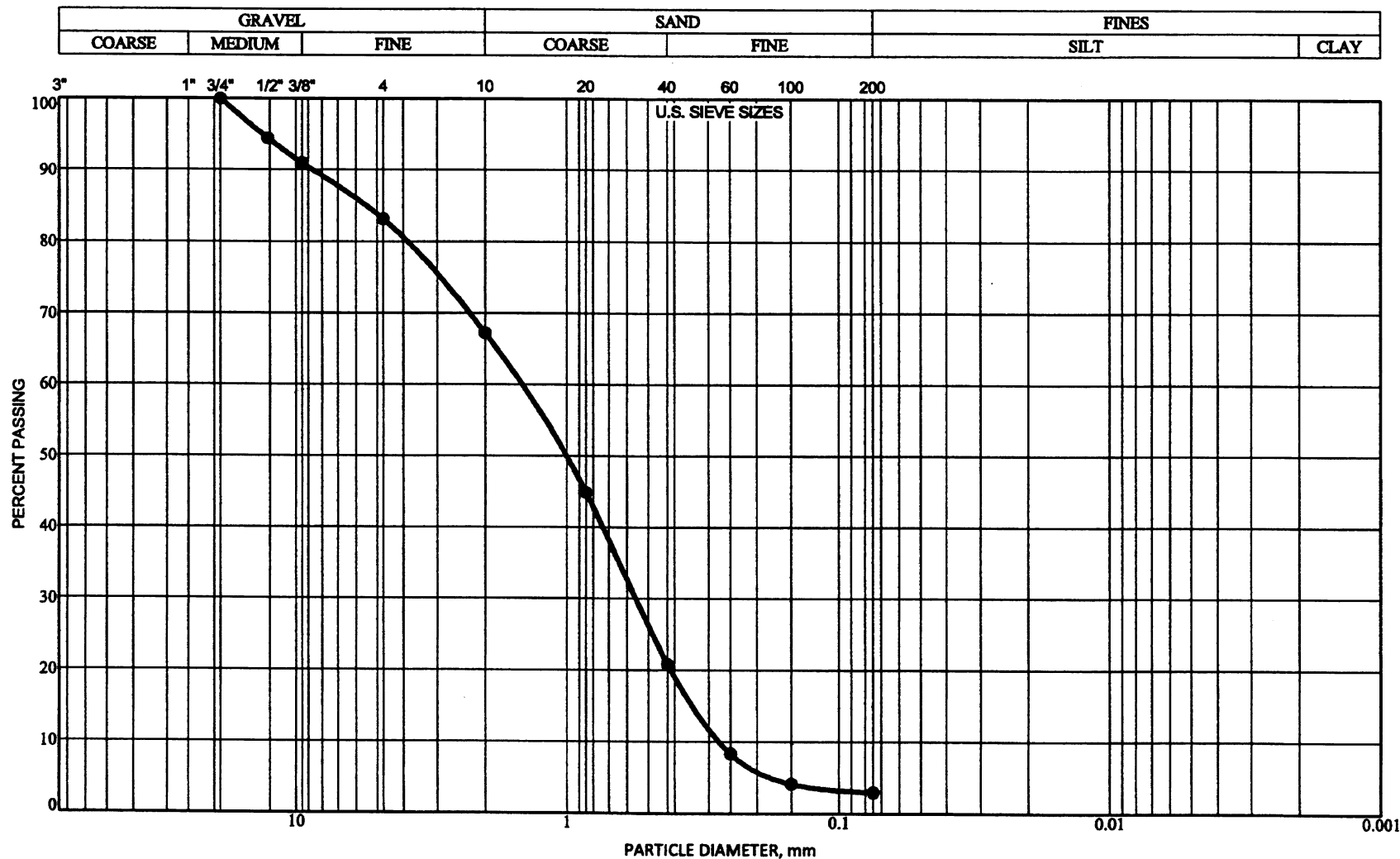
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-4 DEPTH: 70.0'

GRAVEL	0.1%
SAND	97.2%
FINES	2.7%

Mn/DOT Classification: SAND

M:\DOT\VEISCH2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_VB_CURRENT.GDT 9/26/11 08:55

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-5 DEPTH: 15.0'

GRAVEL	32.8%
SAND	64.3%
FINES	2.9%

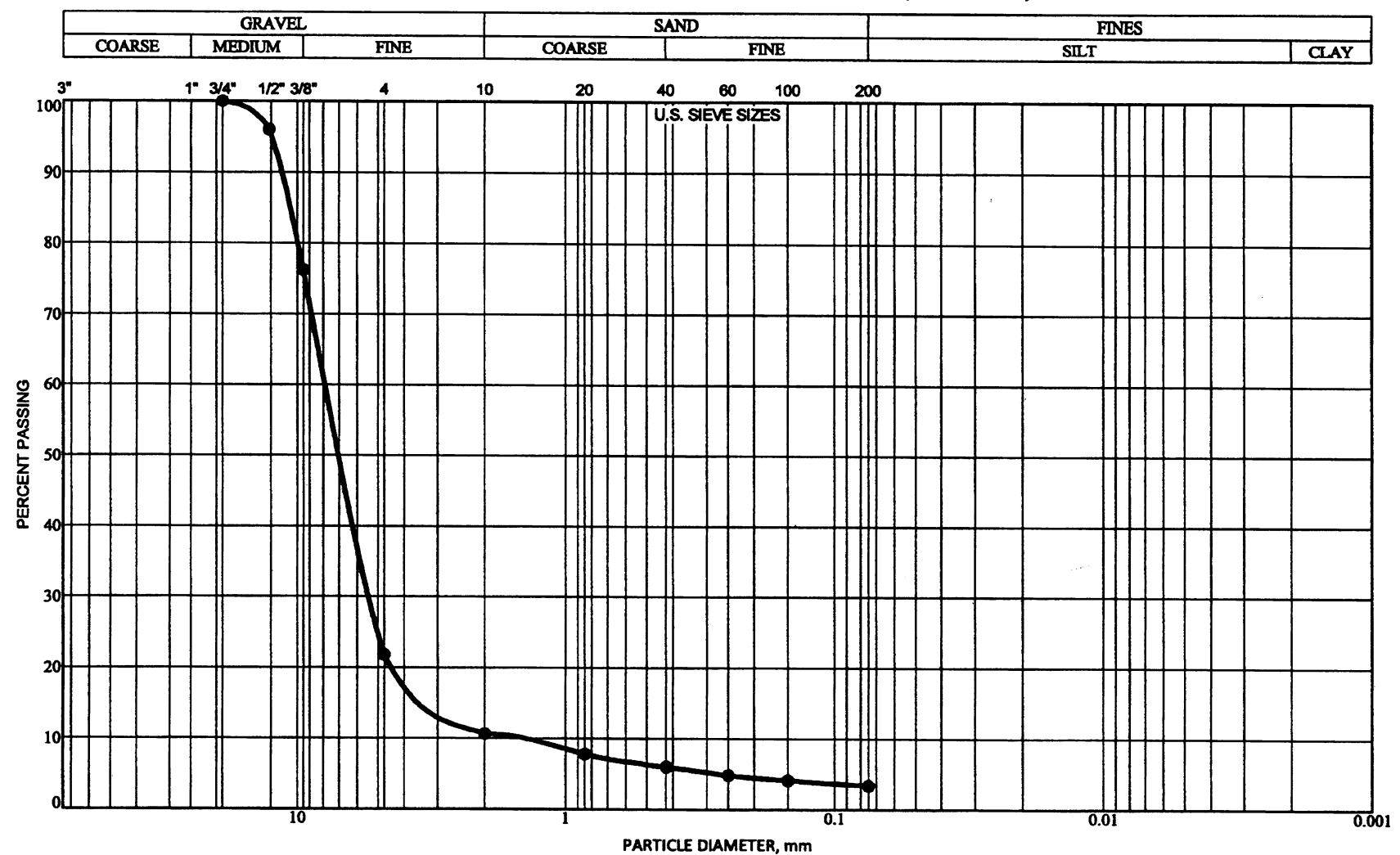
Mn/DOT Classification: SAND with GRAVEL

BL-09-00745A

Braun Intertec Corporation

M:\DOT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



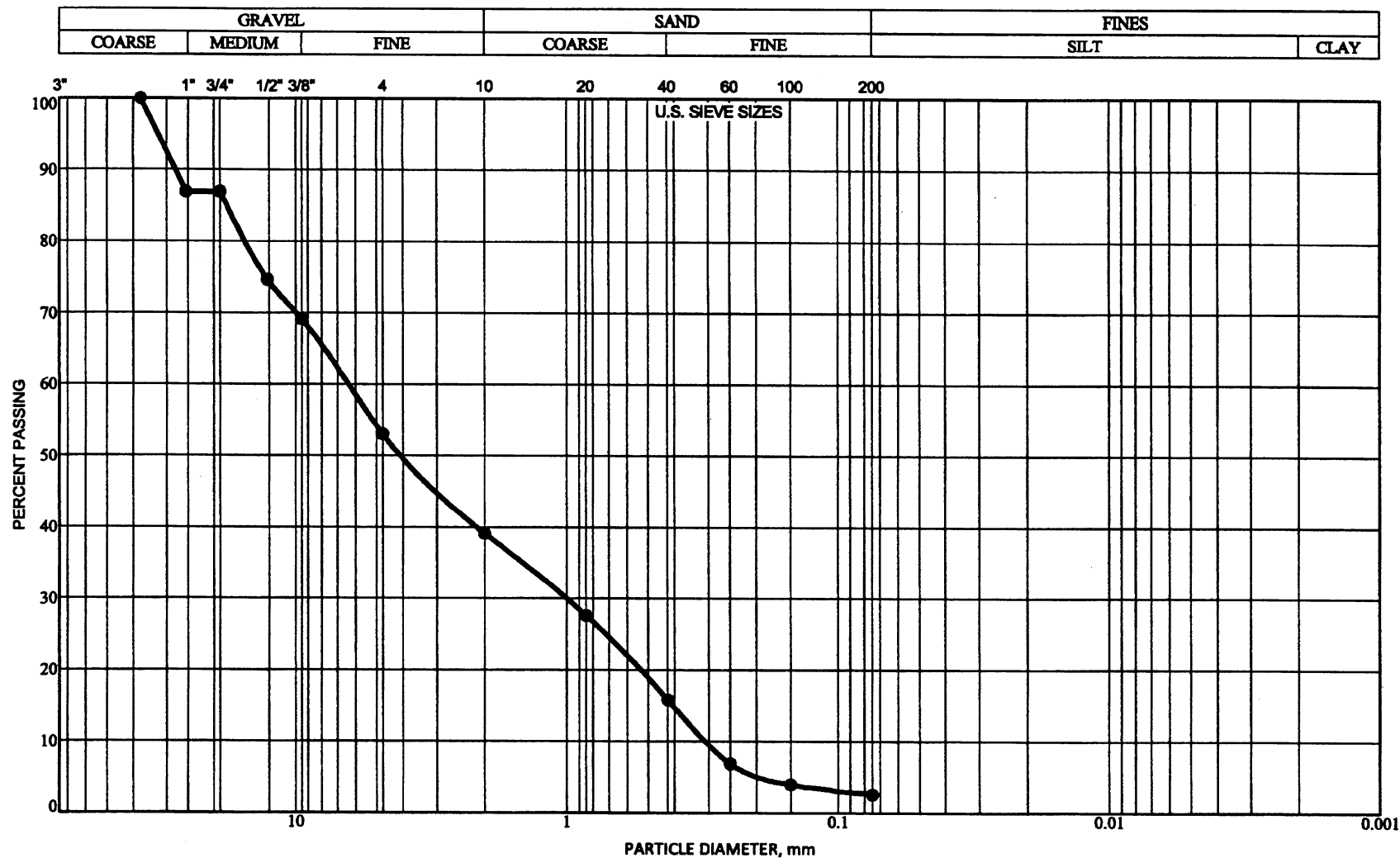
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-5 DEPTH: 40.0'

GRAVEL 89.3%
SAND 7.3%
FINES 3.4%

Mn/DOT Classification: GRAVEL

M:\DOT\PROJECTS\Y-GEO\LAB1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-5 DEPTH: 55.0'

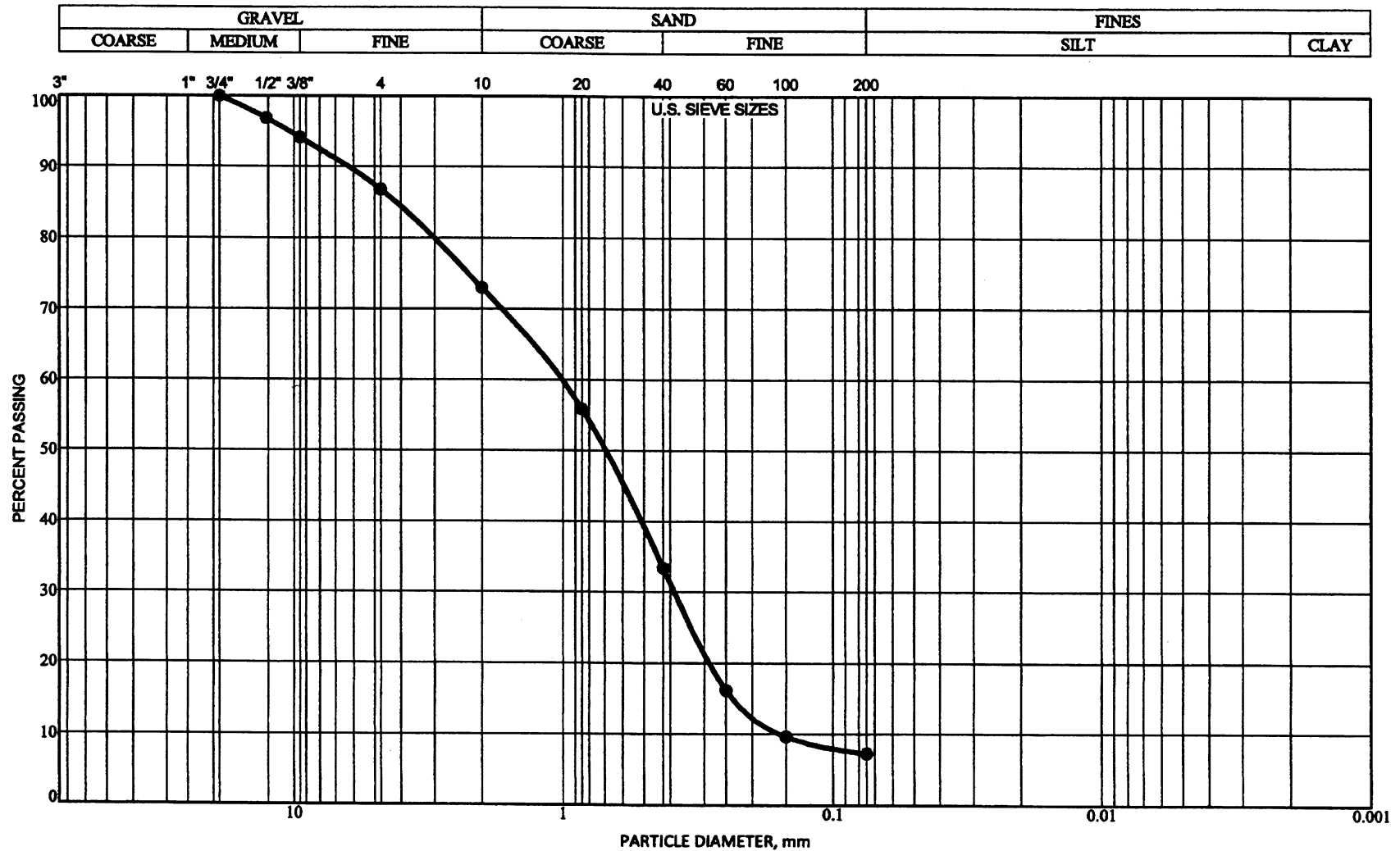
GRAVEL	60.9%
SAND	36.5%
FINES	2.6%

Mn/DOT Classification: GRAVEL

BL-09-00745A

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



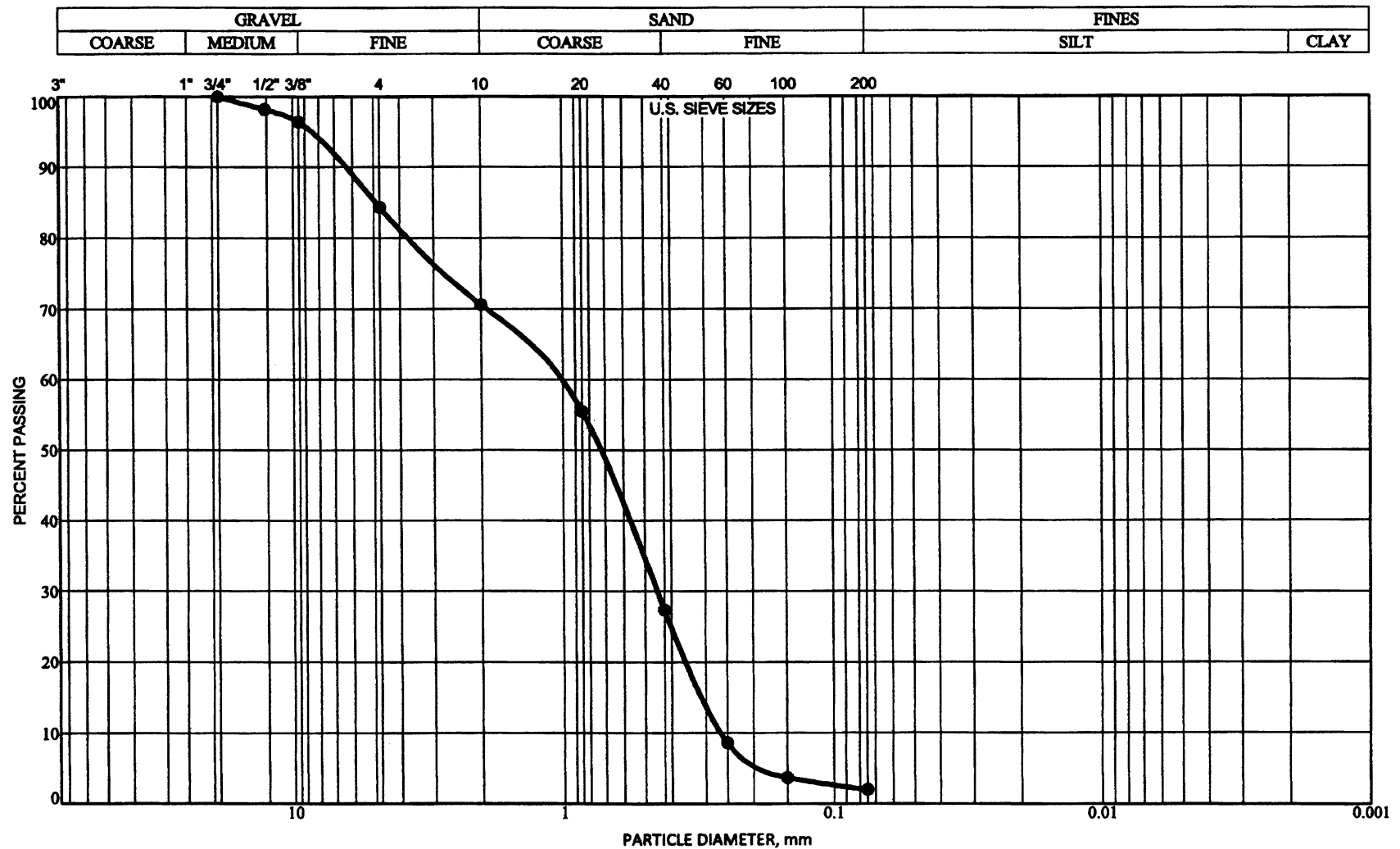
BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-6 DEPTH: 5.0'

GRAVEL	27.0%
SAND	65.7%
FINES	7.3%

Mn/DOT Classification: SAND with GRAVEL

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-6 DEPTH: 37.5'

GRAVEL	29.4%
SAND	68.6%
FINES	2.0%

Mn/DOT Classification: SAND with GRAVEL

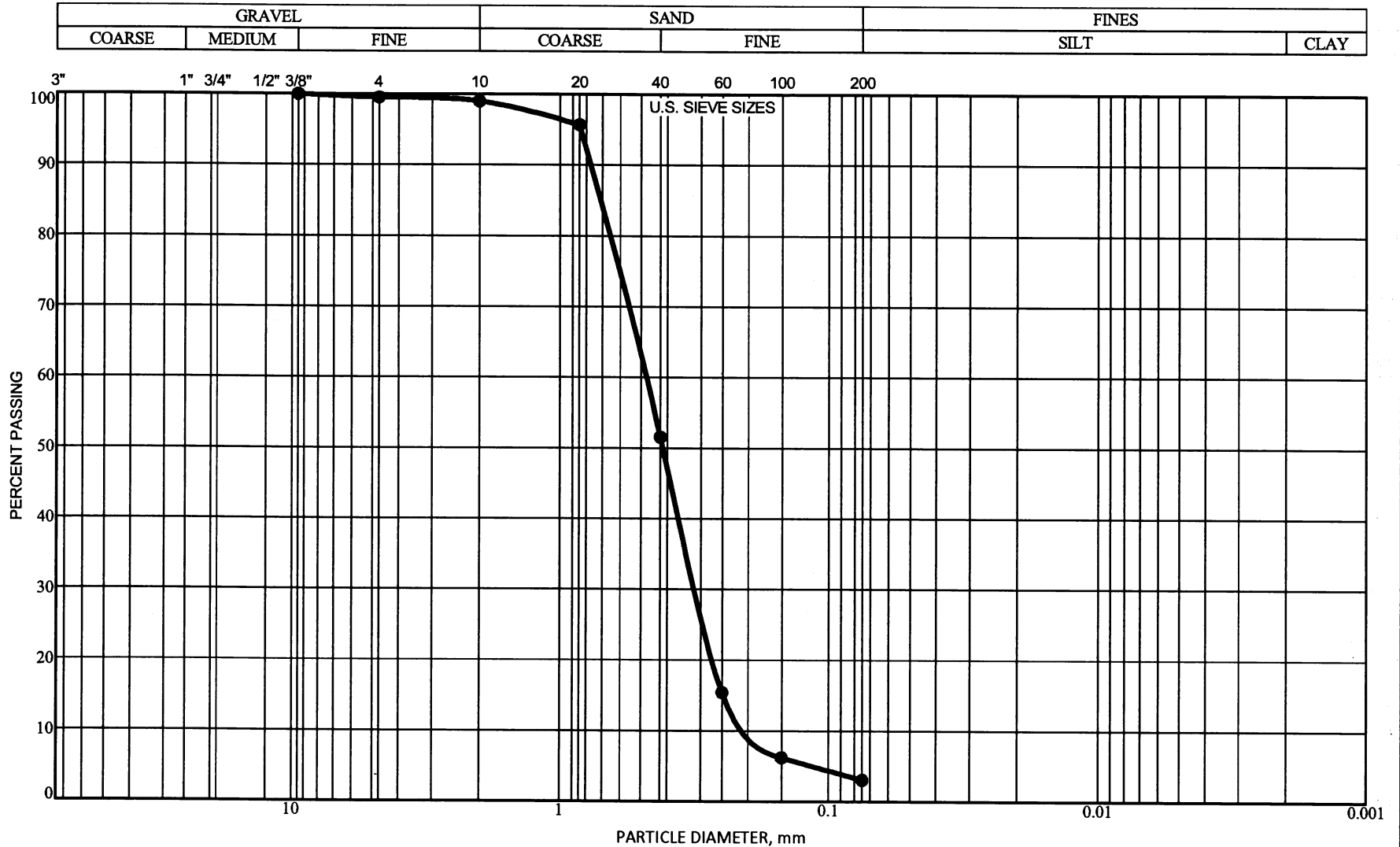
M:\DOT\PROJECTS\Y-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GOT 9/26/11 08:56

BL-09-00745A

Braun Intertec Corporation

MANDOTVERS012 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

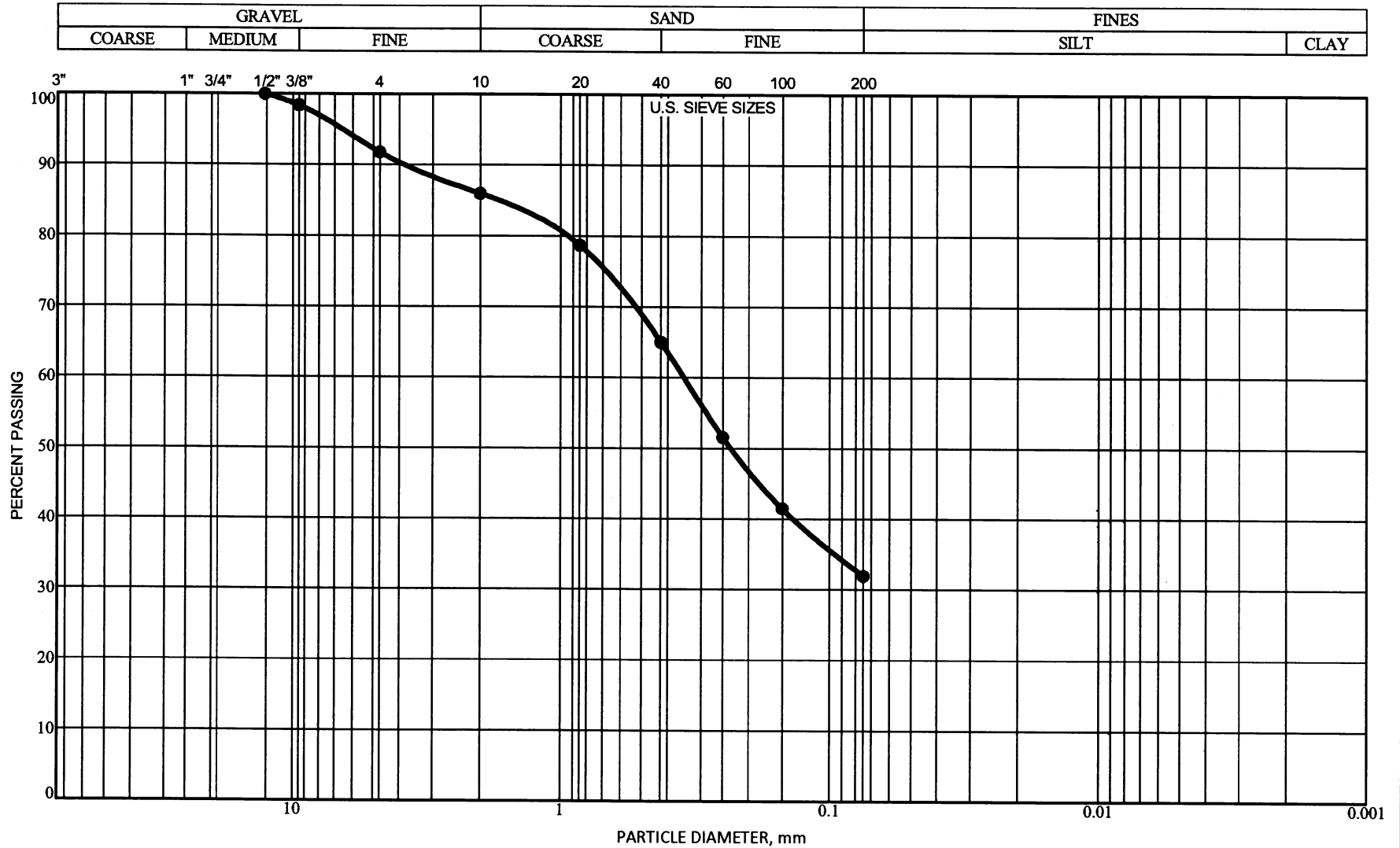
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-6 DEPTH: 60.0'

GRAVEL	1.0%
SAND	96.0%
FINES	3.0%

Mn/DOT Classification: SAND

M:\DOT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

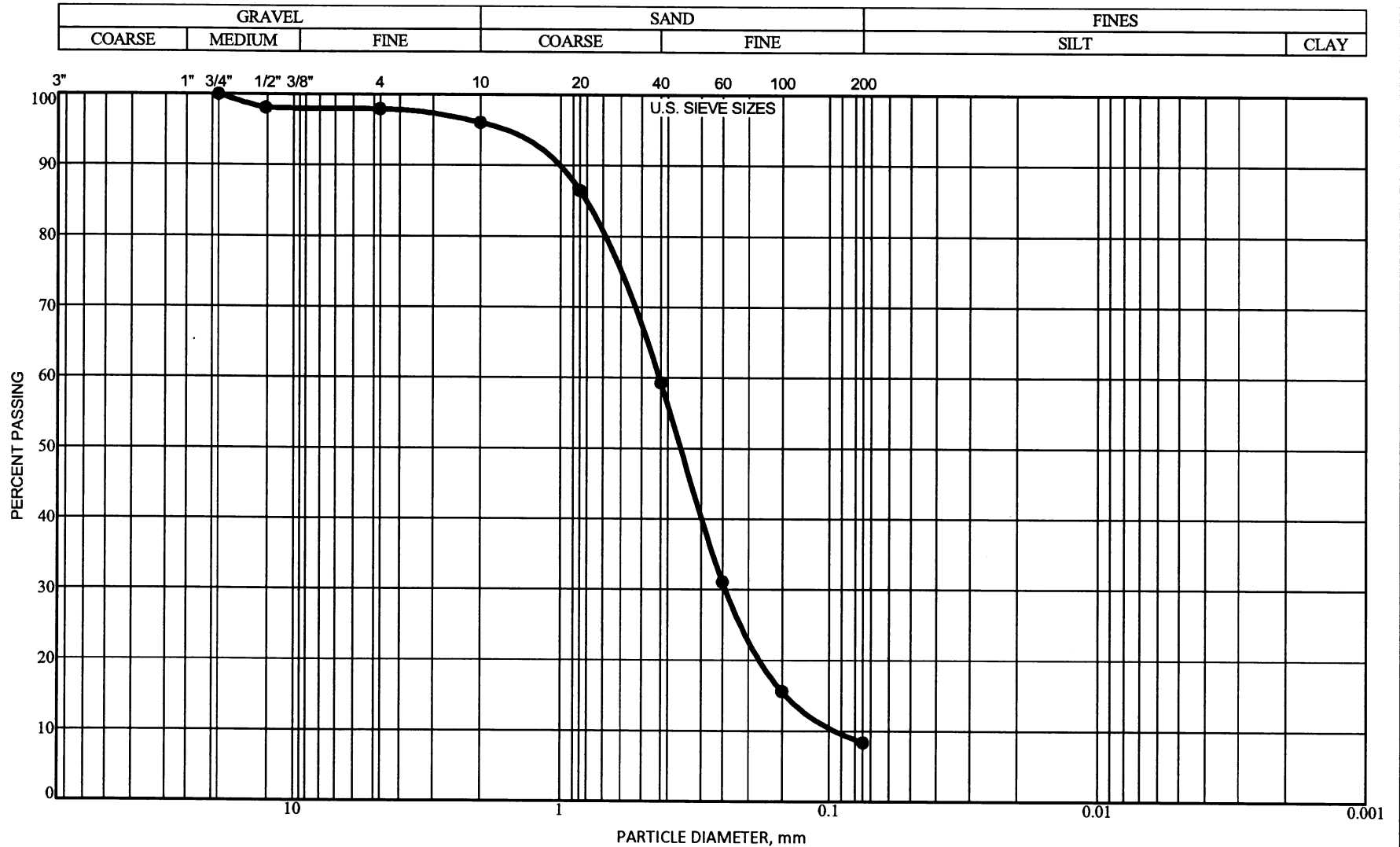
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-6 DEPTH: 70.0'

GRAVEL	14.0%
SAND	54.0%
FINES	31.9%

Mn/DOT Classification: SANDY LOAM

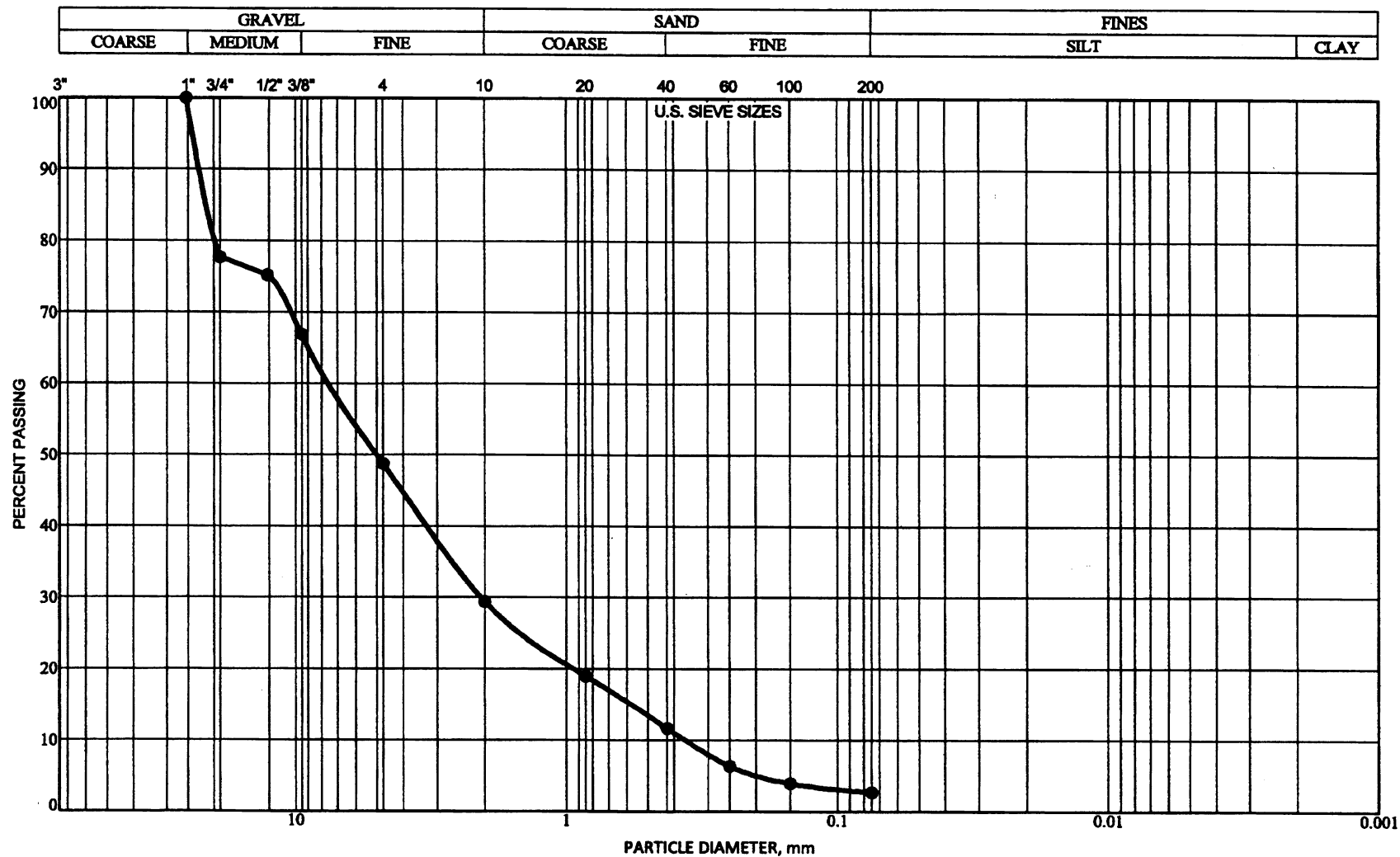
MNDOT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



M:\DOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-7 DEPTH: 30.0'

GRAVEL	70.6%
SAND	26.7%
FINES	2.7%

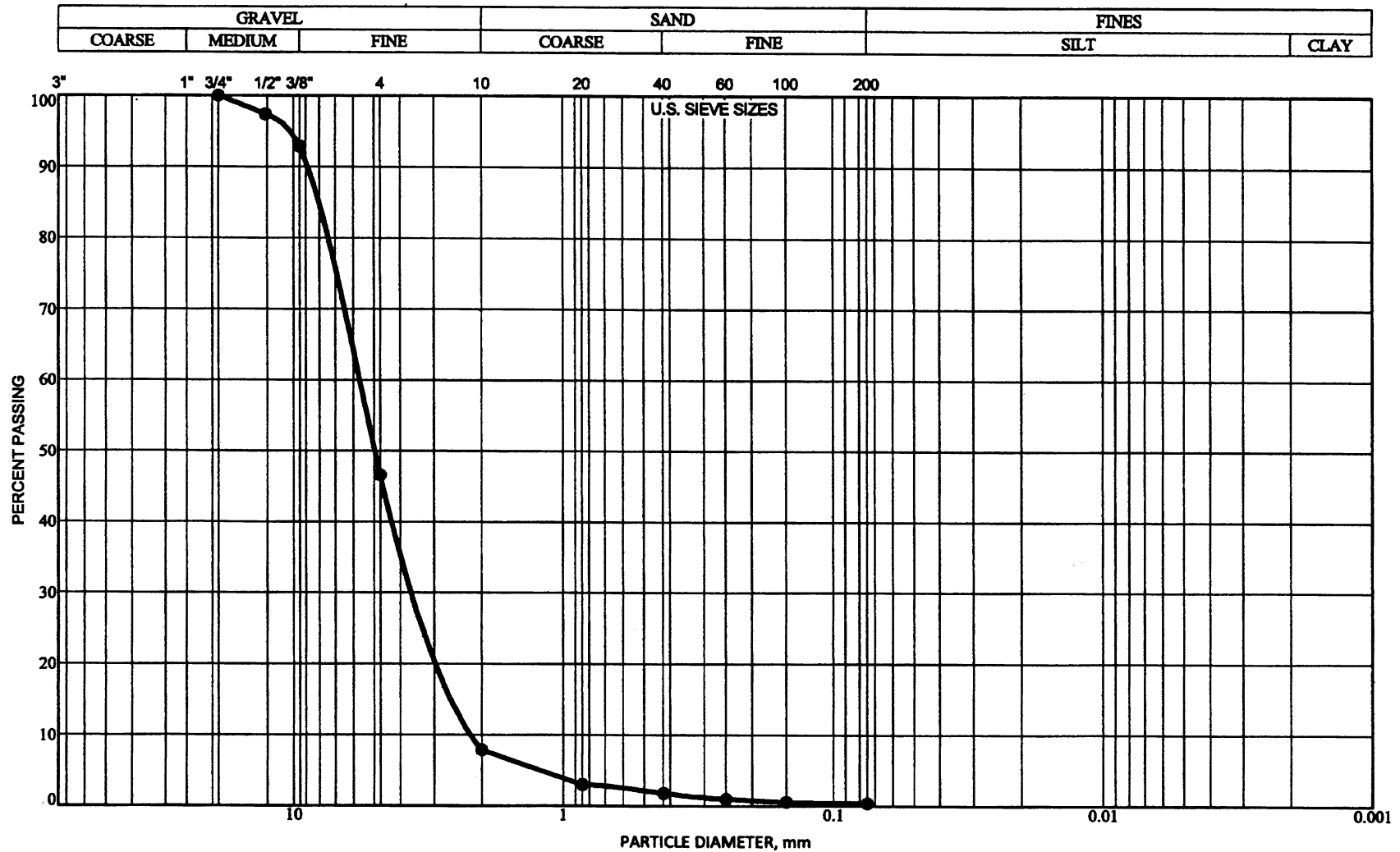
Mn/DOT Classification: GRAVEL

BL-09-00745A

Braun Intertec Corporation

M:\DOT\VERSION2 N:\GINT\PROJECTS\X-GEOLAB1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-7 DEPTH: 37.5'

GRAVEL	92.1%
SAND	7.5%
FINES	0.4%

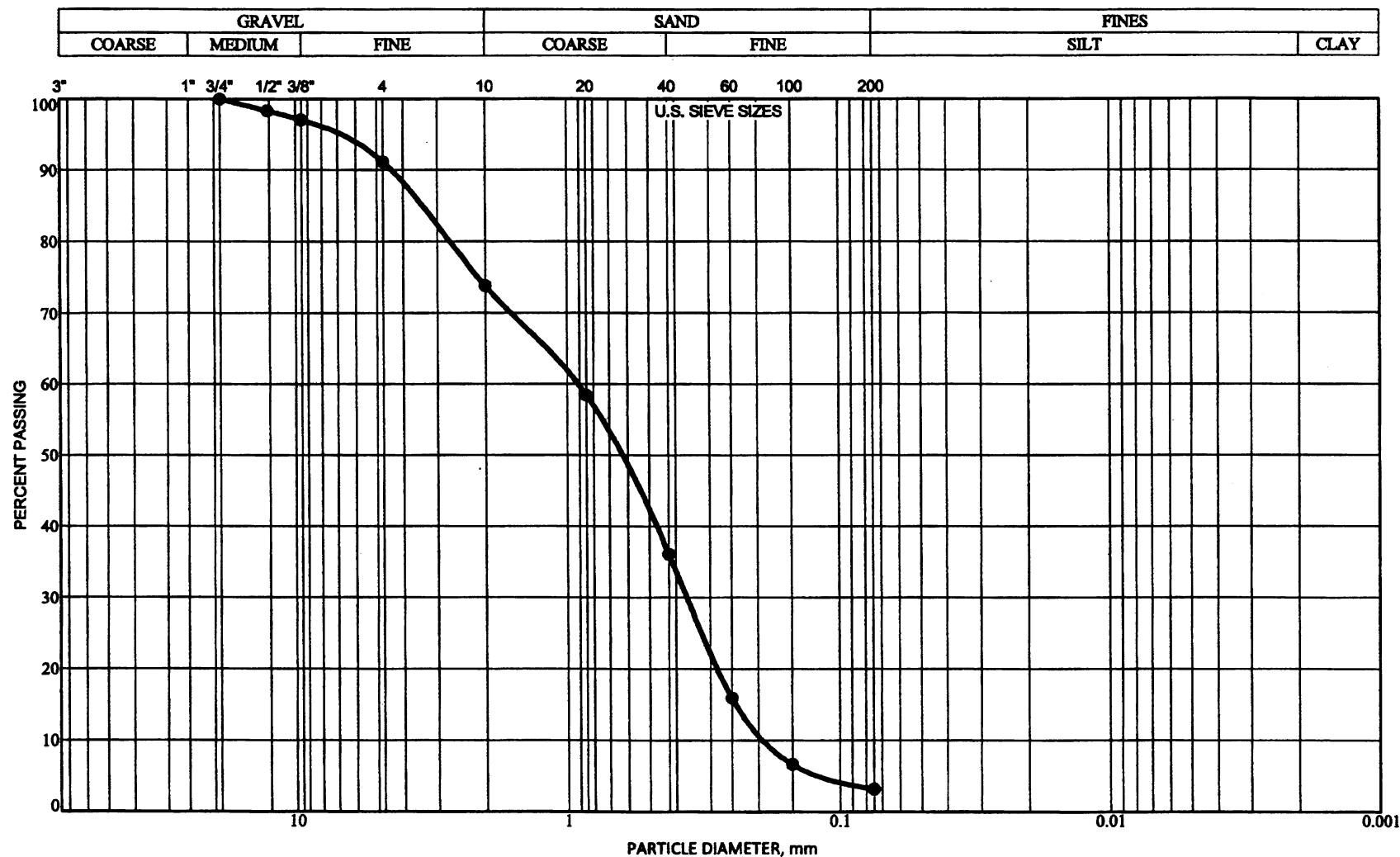
Mn/DOT Classification: GRAVEL

BL-09-00745A

Braun Intertec Corporation

M:\DOT\PROJECTS\X-GEO\LA\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_VA_CURRENT.GDT 9/26/11 08:56

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-7 DEPTH: 50.0'

GRAVEL	26.2%
SAND	70.6%
FINES	3.1%

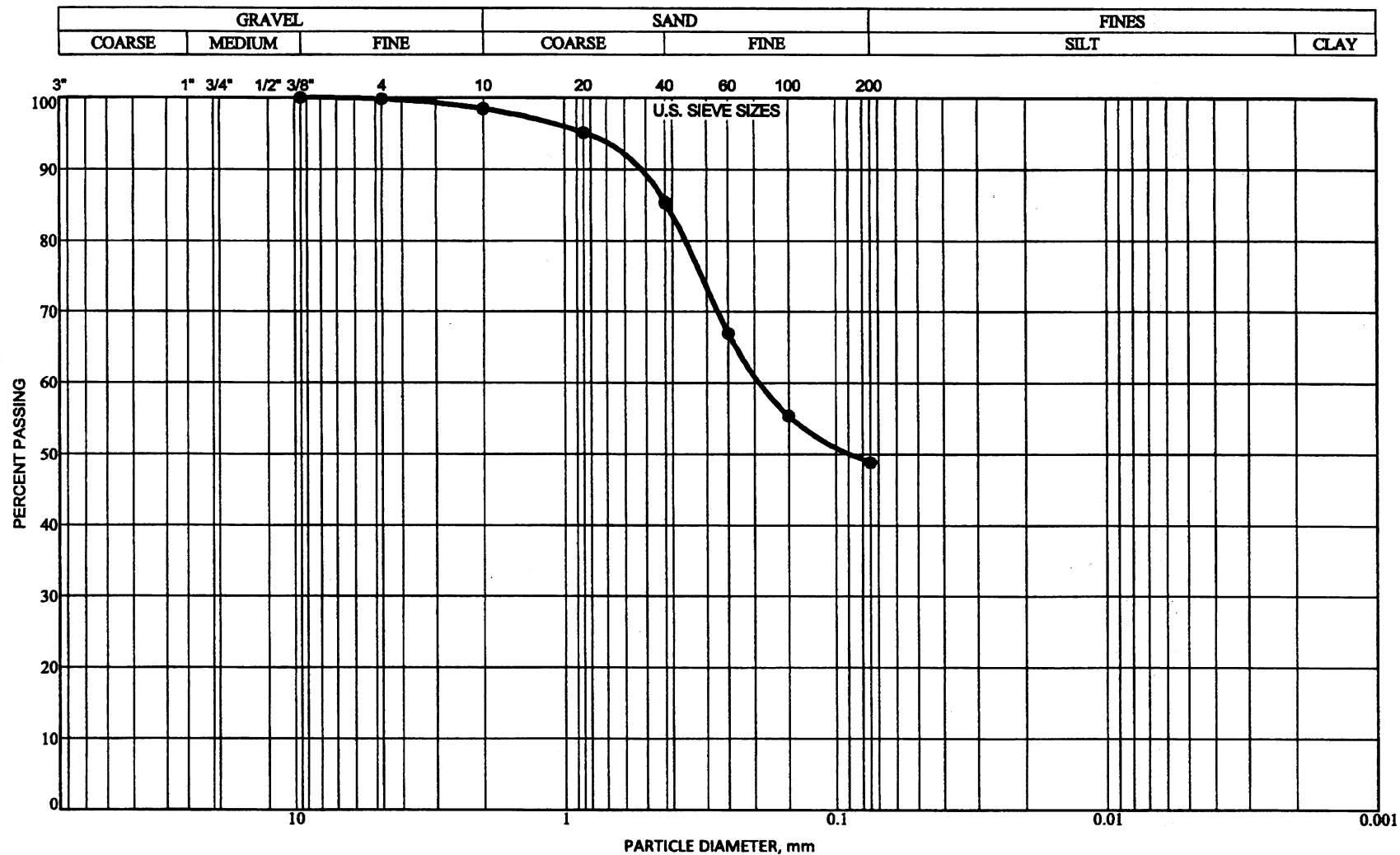
Mn/DOT Classification: SAND with GRAVEL

BL-09-00745A

Braun Intertec Corporation

M:\DOT\PROJECTS\X-GEO\LAB1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 8/19/11 10:14

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-7 DEPTH: 60.0'

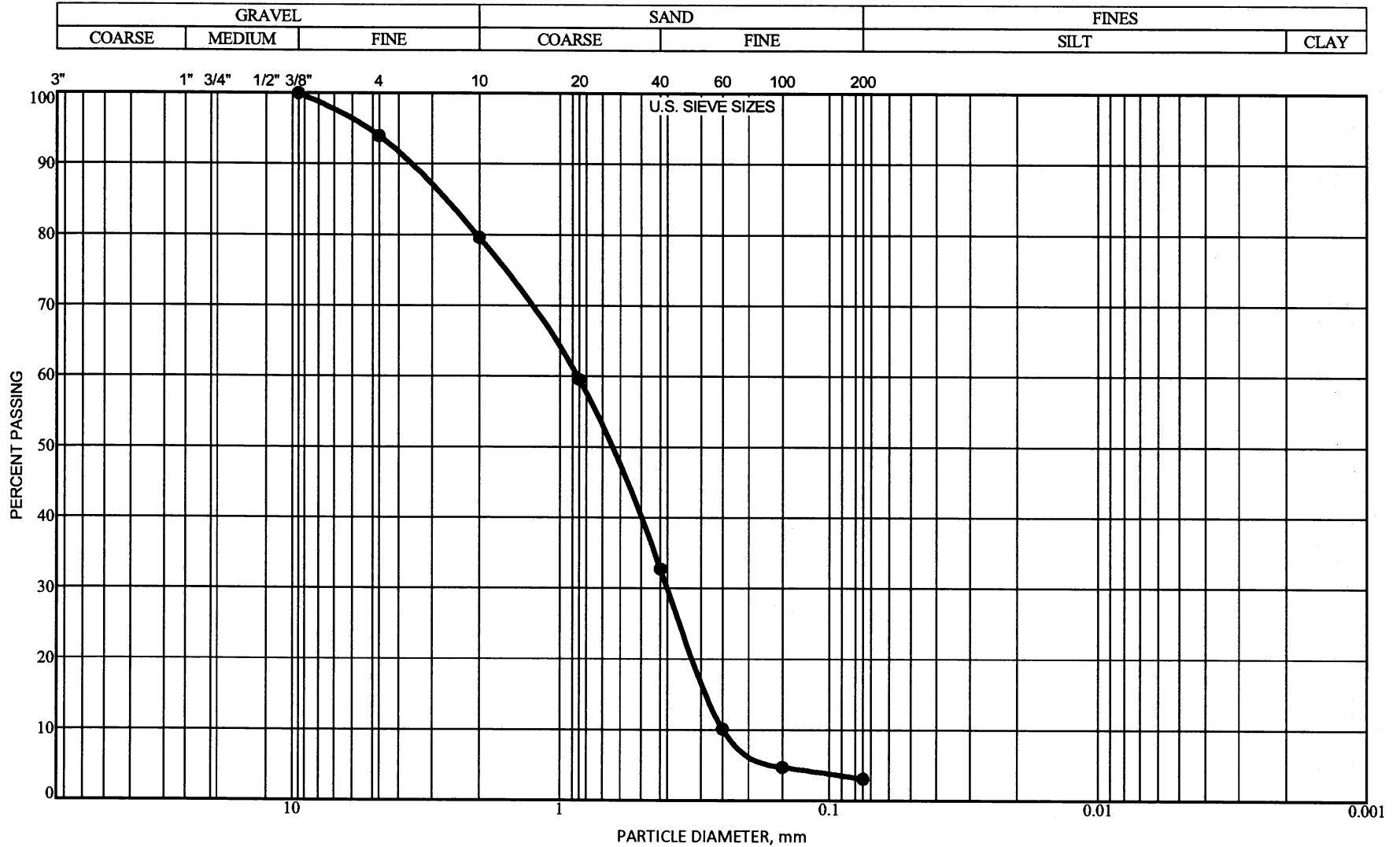
GRAVEL	1.5%
SAND	49.6%
FINES	48.9%

Mn/DOT Classification: SANDY LOAM

BL-09-00745A

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



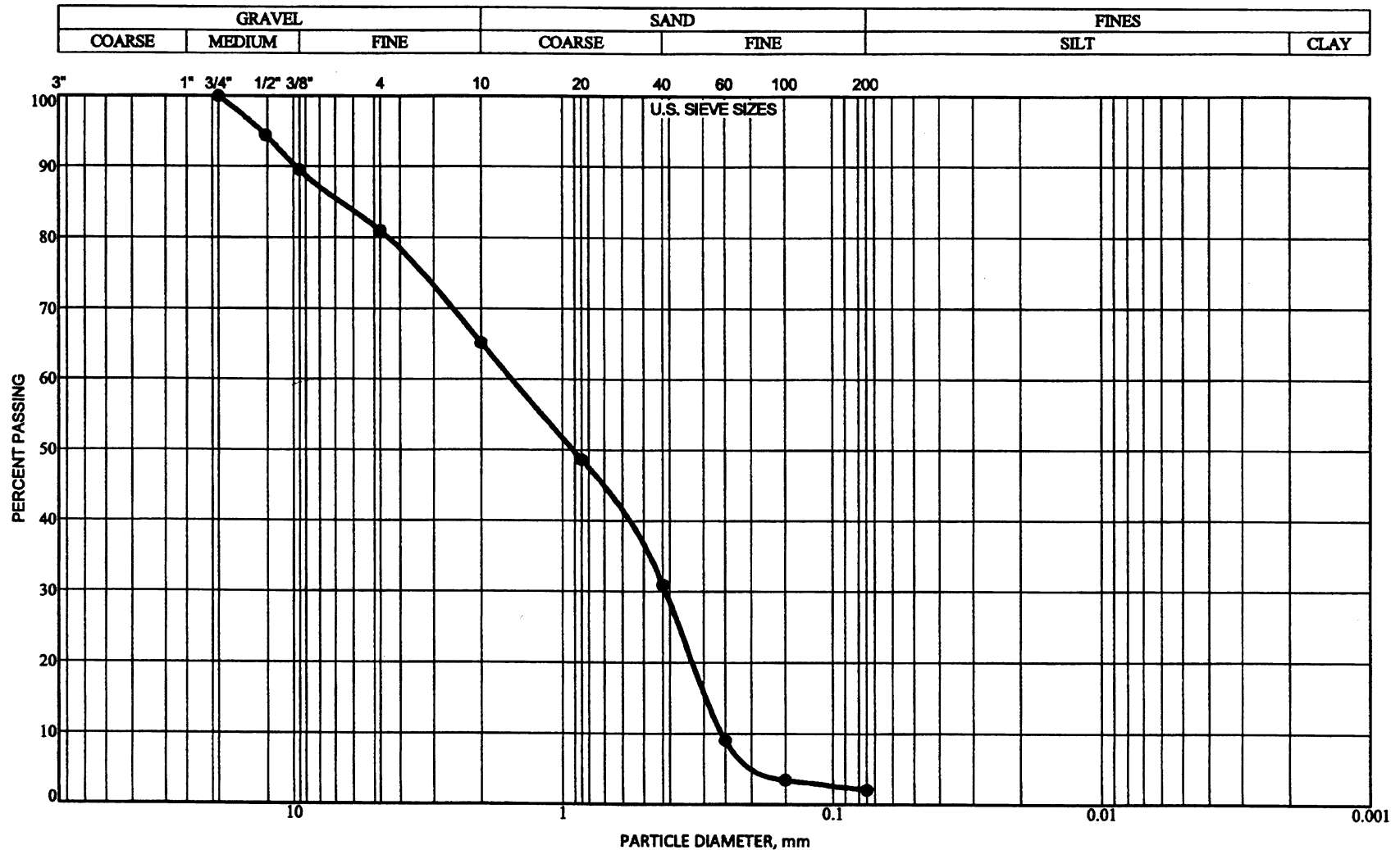
BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
 BORING: R-8 DEPTH: 32.5'

GRAVEL	20.4%
SAND	76.5%
FINES	3.1%

Mn/DOT Classification: SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: R-8 DEPTH: 50.0'

GRAVEL	34.8%
SAND	63.2%
FINES	2.0%

Mn/DOT Classification: SAND with GRAVEL

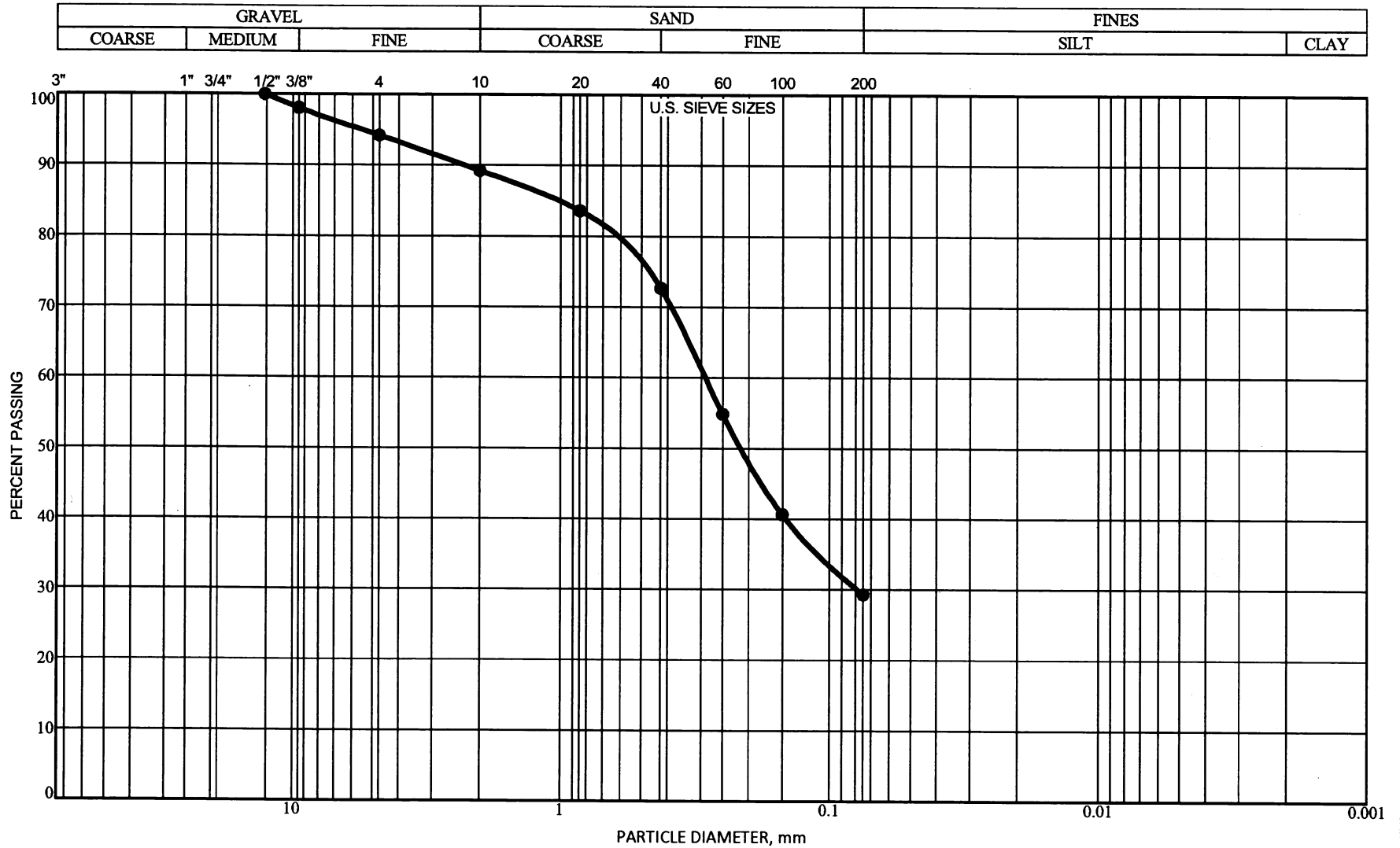
M:\DOT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:56

BL-09-00745A

Braun Intertec Corporation

MINDOTVERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-8 DEPTH: 60.0'

GRAVEL	10.8%
SAND	59.9%
FINES	29.3%

Mn/DOT Classification: SANDY LOAM

BL-09-00745A

Braun Intertec Corporation

N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-0074SA.GPJ BRAUN V8 CURRENT.GDT 9/26/11 08:56

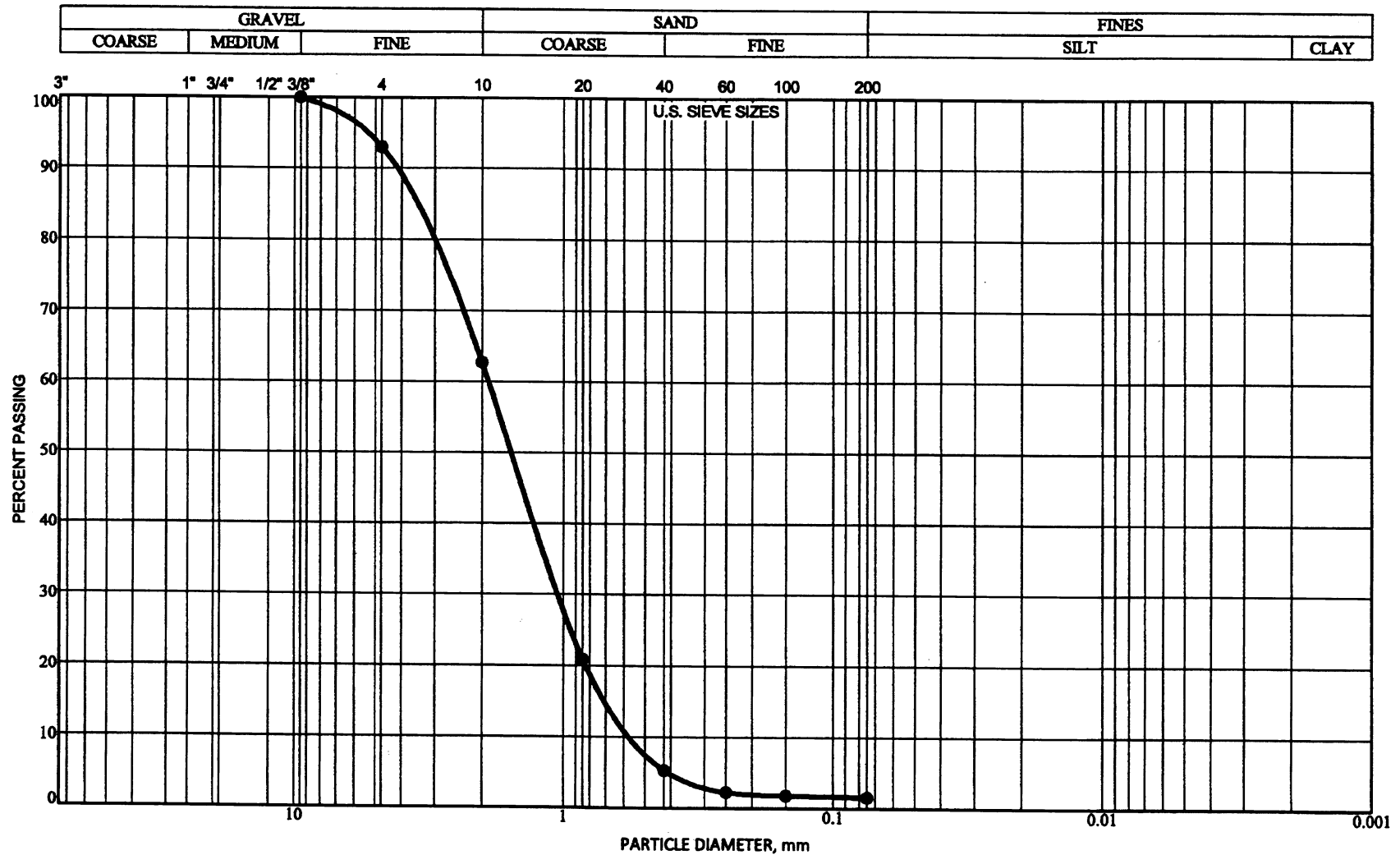


Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-9 DEPTH: 35.0'

**Mn/DOT Classification: Loamy SAND
with GRAVEL**

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: R-9 DEPTH: 50.0'

GRAVEL	37.3%
SAND	61.2%
FINES	1.5%

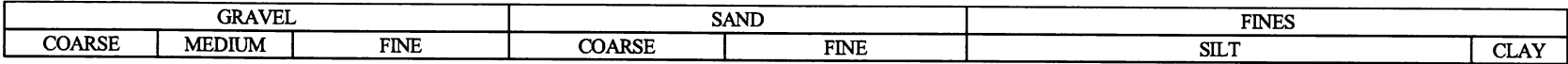
Mn/DOT Classification: SAND with GRAVEL

M:\DOT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:56

BL-09-00745A

Braun Intertec Corporation

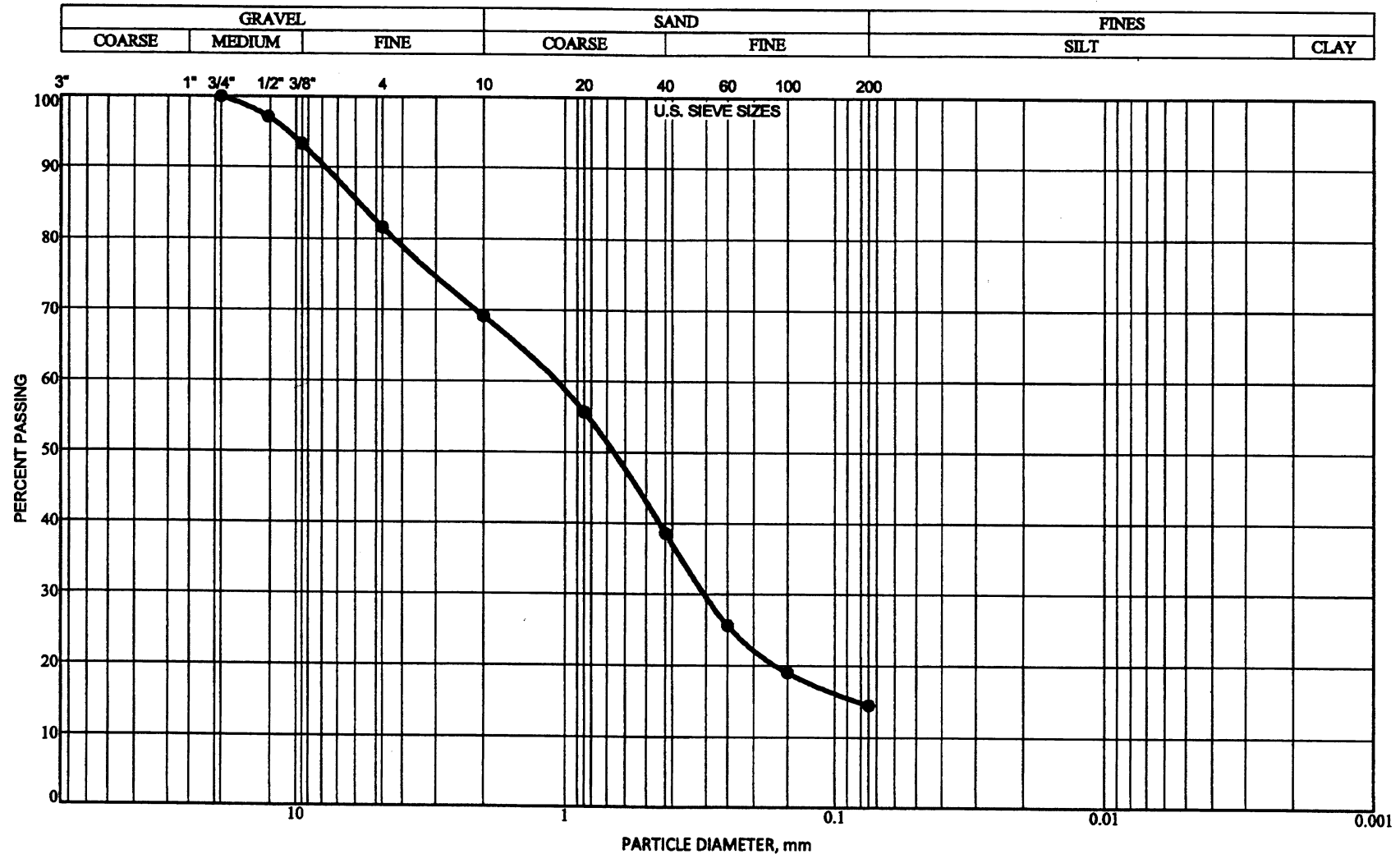
MNDOT\VERSOIN2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44



Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
 BORING: R-9 DEPTH: 60.0'

Mn/DOT Classification: SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: S-1 DEPTH: 5.0'

GRAVEL	30.8%
SAND	54.7%
FINES	14.5%

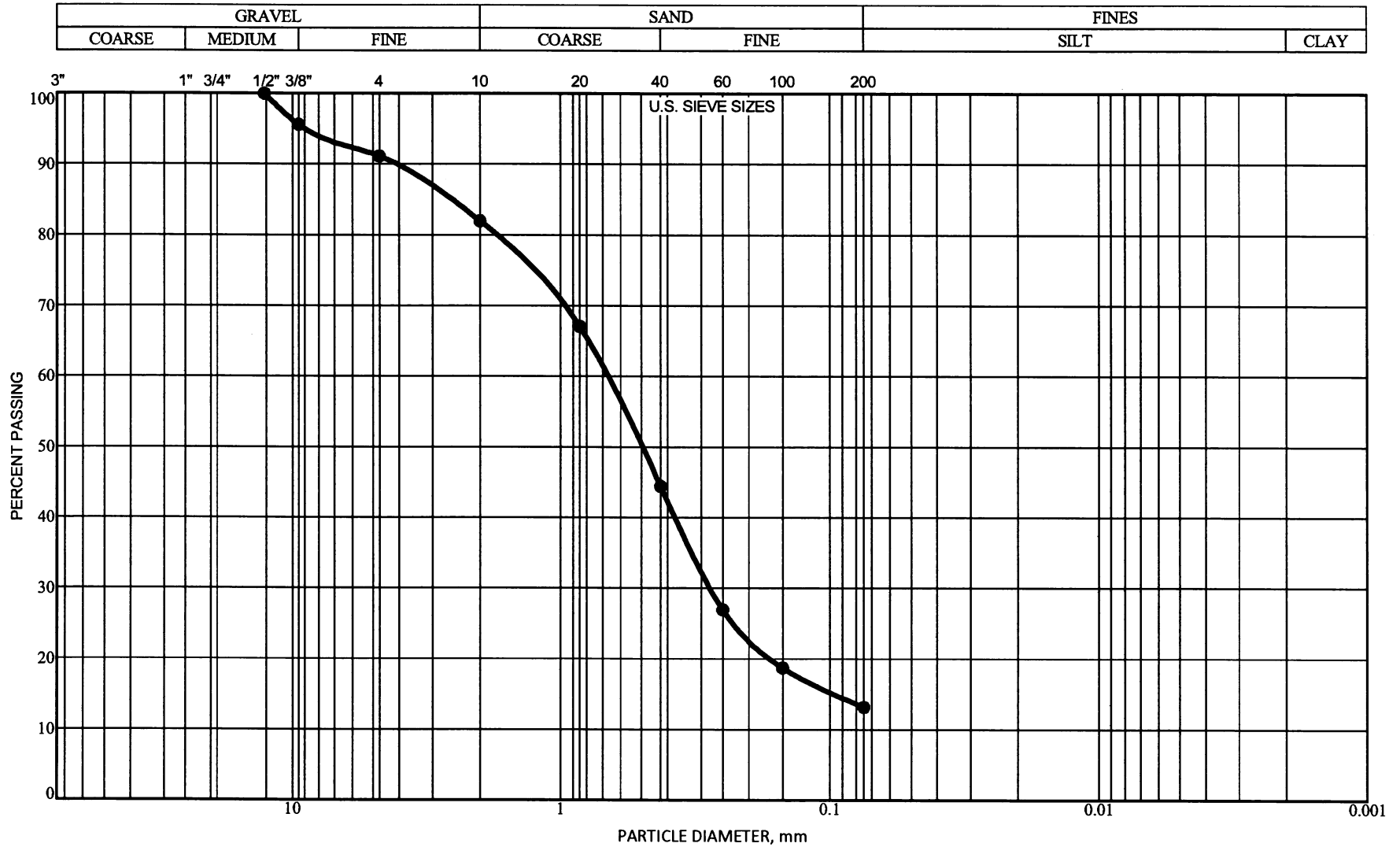
Mn/DOT Classification: Loamy SAND
with GRAVEL

BL-09-00745A

Braun Intertec Corporation

MINDOTVERS01N2 N:\GINT\PROJECTS\X-GEO\LAB1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:56

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



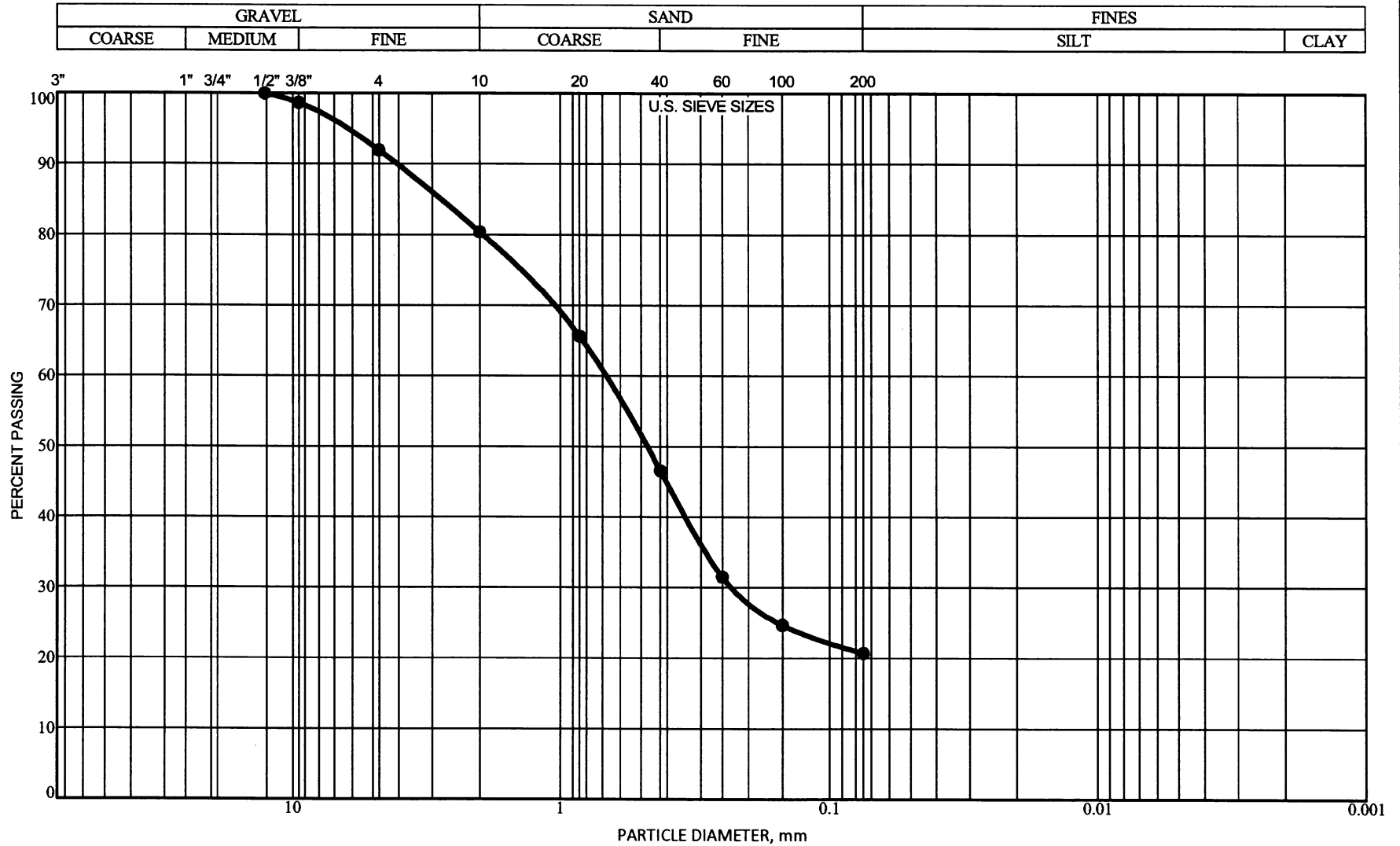
BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
 BORING: S-12 DEPTH: 3.0'

GRAVEL	18.0%
SAND	68.8%
FINES	13.2%

Mn/DOT Classification: Loamy SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

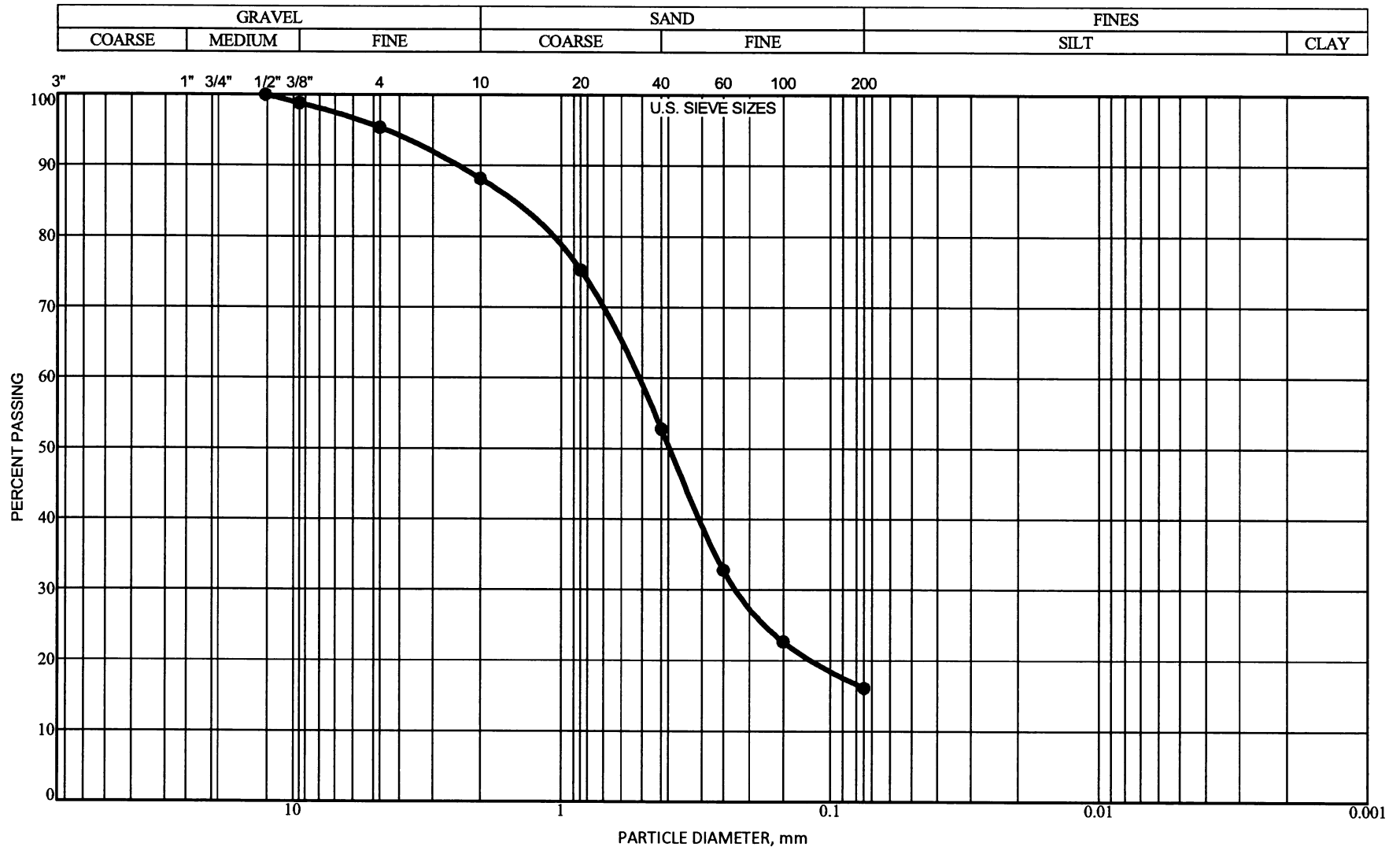
Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
 BORING: S-13 DEPTH: 2.0'-7.0'

GRAVEL	19.6%
SAND	59.7%
FINES	20.7%

Mn/DOT Classification: SANDY LOAM

MINDOT\VERSION2 N:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 10:44

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



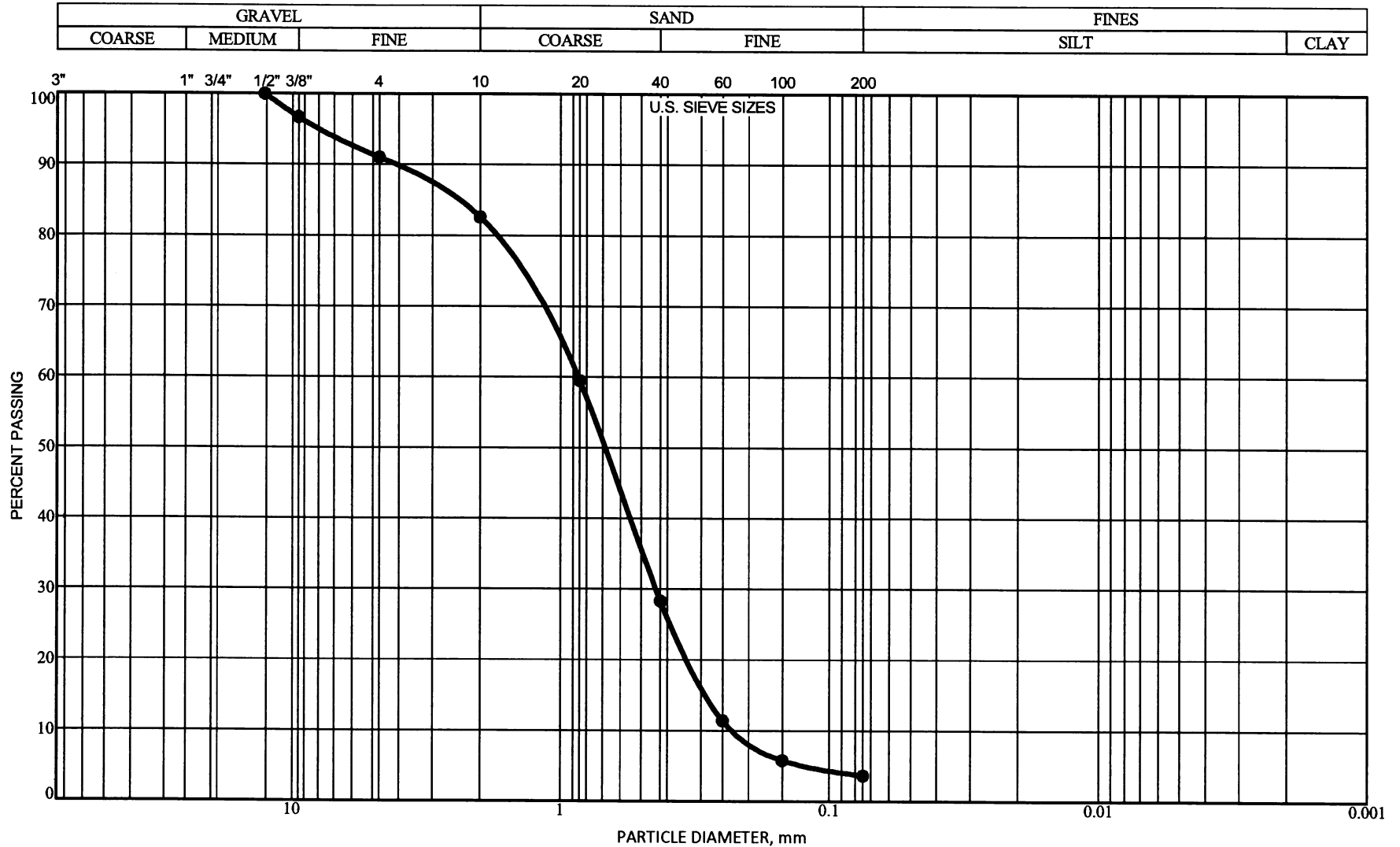
BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: S-14 DEPTH: 3.0'

GRAVEL	11.8%
SAND	72.1%
FINES	16.1%

Mn/DOT Classification: Loamy SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



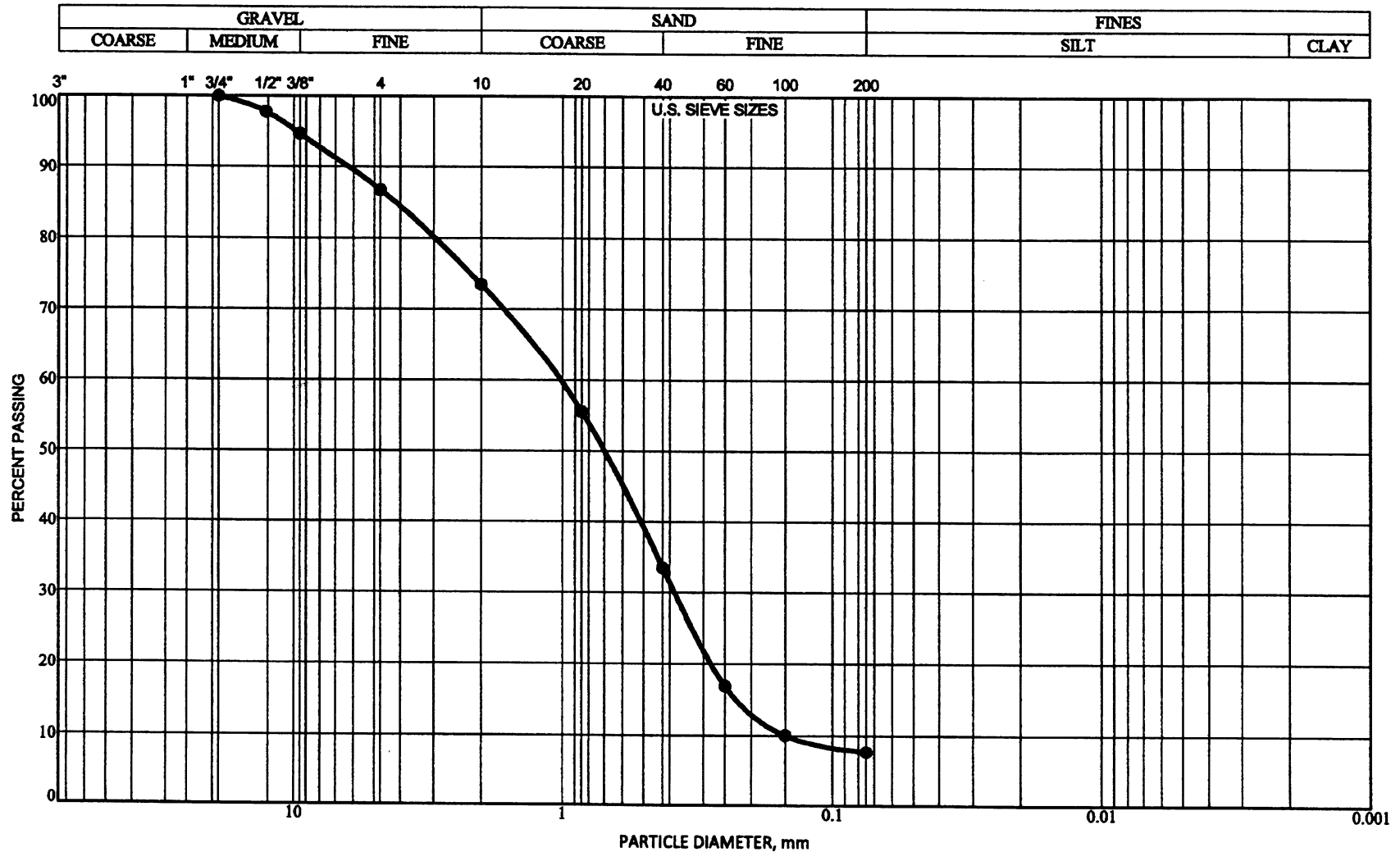
BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
 BORING: S-17 DEPTH: 3.0'-6.0'

GRAVEL	17.4%
SAND	78.9%
FINES	3.6%

Mn/DOT Classification: SAND

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: S-18 DEPTH: 1.0'-6.0'

GRAVEL	26.5%
SAND	65.8%
FINES	7.7%

Mn/DOT Classification: SAND with GRAVEL

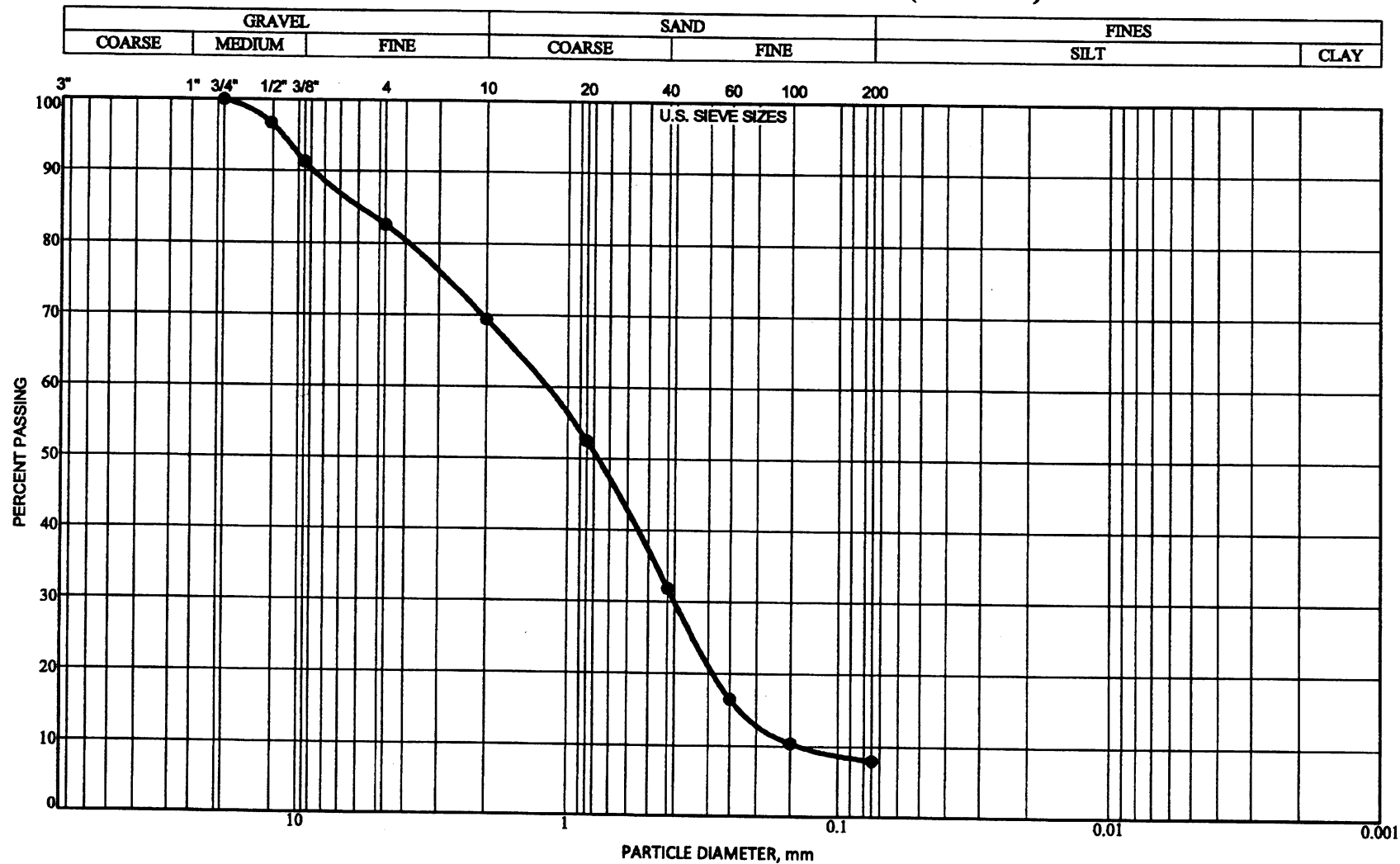
M:\DOT\ENGIN2\N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:56

BL-09-00745A

Braun Intertec Corporation

MINDOT\PROJECTS\GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:56

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, Minnesota
BORING: S-19 DEPTH: 1.0'-6.0'

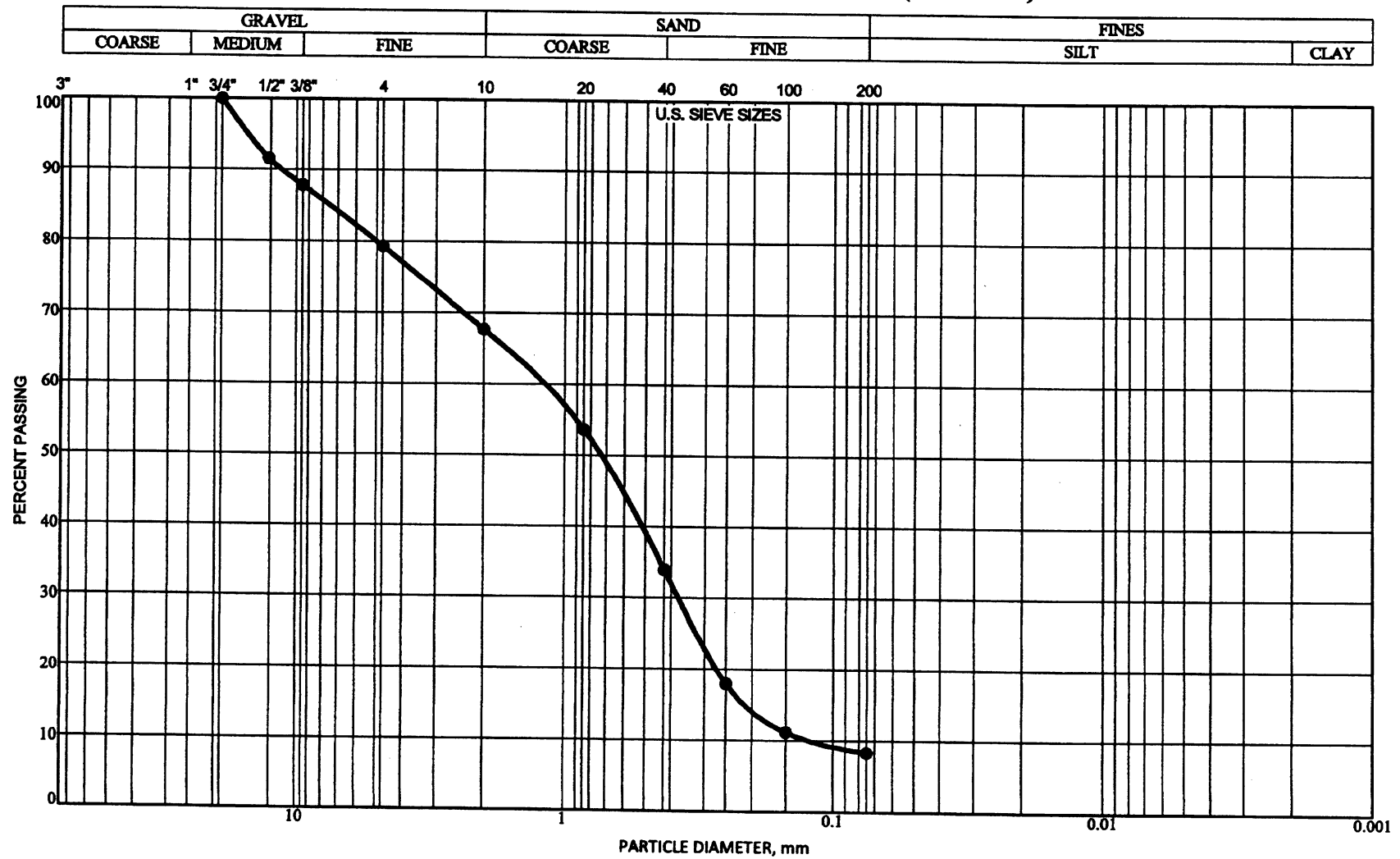
GRAVEL	30.6%
SAND	61.4%
FINES	8.0%

Mn/DOT Classification: SAND with
GRAVEL

BL-09-00745A

Braun Intertec Corporation

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: S-20 DEPTH: 1.0'-6.0'

GRAVEL	32.3%
SAND	59.4%
FINES	8.3%

Mn/DOT Classification: SAND with GRAVEL

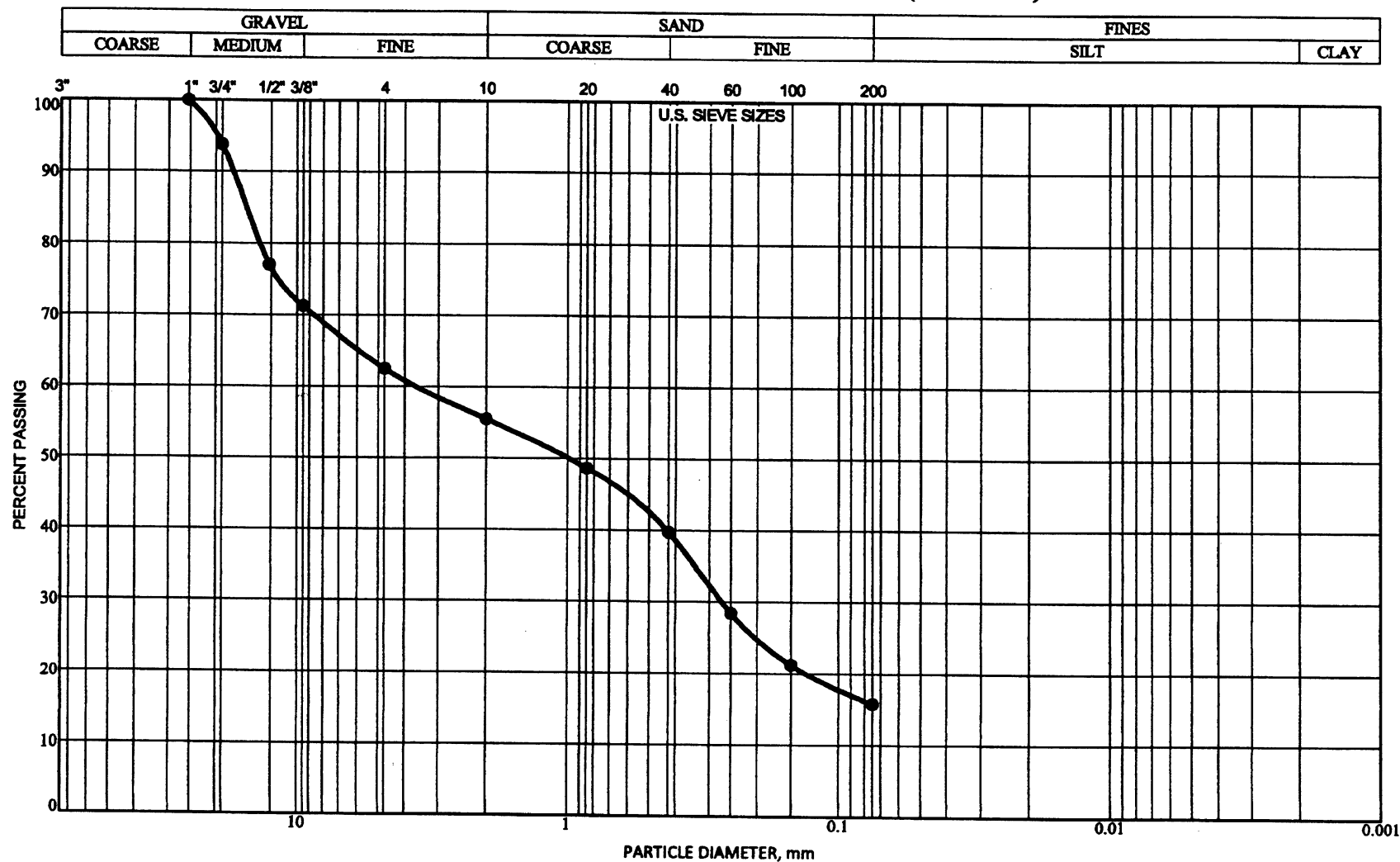
BL-09-00745A

Braun Intertec Corporation

MINDOTVERSION2 H:\GINT\PROJECTS\X-GEO\LAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_V8_CURRENT.GDT 9/26/11 08:56

M:\DOT\VERSION2 N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\MINNEAPOLIS\2009\BL-09-00745A.GPJ BRAUN_VB_CURRENT.GDT 9/26/11 08:56

GRAIN SIZE ACCUMULATION CURVE (Mn/DOT)



BRAUNSM
INTERTEC

Braun Project BL-09-00745A
SOIL BORINGS AND LABORATORY TESTING
 TH 7 & Louisiana Ave Design
 TH 7 & Louisiana Avenue
 St. Louis Park, Minnesota
 BORING: S-21 DEPTH: 2.0'-6.0'

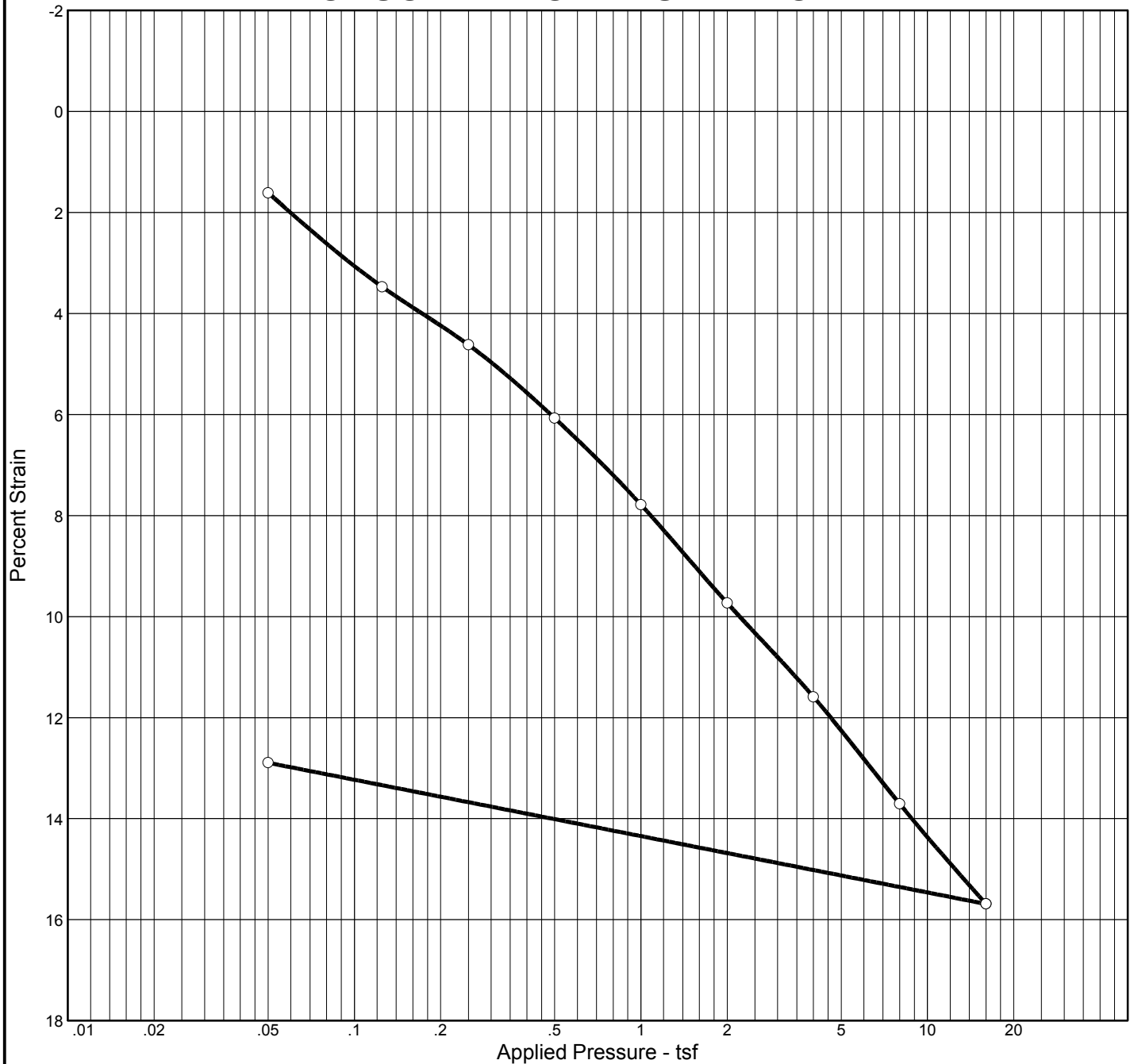
GRAVEL	44.5%
SAND	39.6%
FINES	15.8%

Mn/DOT Classification: Loamy SAND
with GRAVEL

BL-09-00745A


Braun Intertec Corporation

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
101.4 %	28.2 %	96.2			2.70		0.36	0.11	0.02			0.752

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, black and gray (C)		

Project No. BL0900745A Client: Short-Elliott-Hendrickson, Inc.			Remarks: Thinwall
Project: TH 7 & Louisiana Ave Design St. Louis Park, MN			
Source:	Sample No.: E-3	Elev./Depth: 27-29'	
<div></div>			Figure

Figure

Dial Reading vs. Time

Project No.: BL0900745A

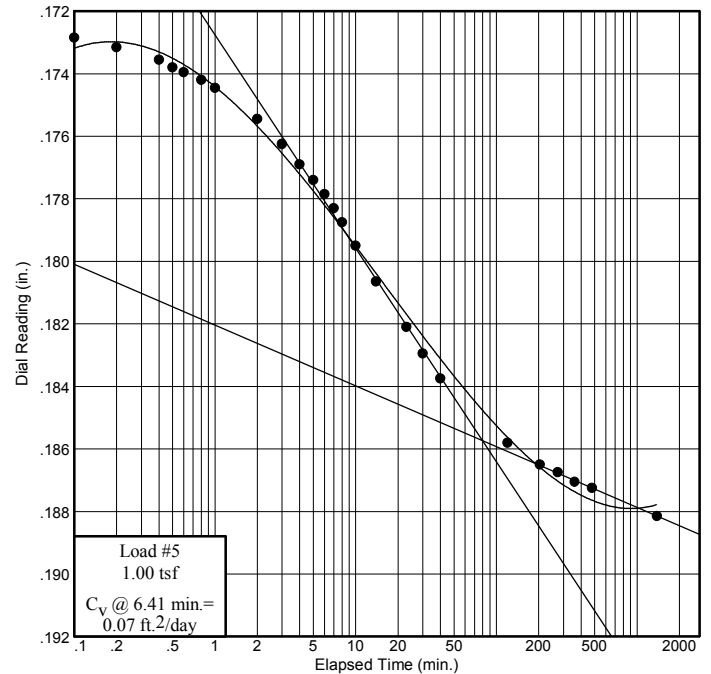
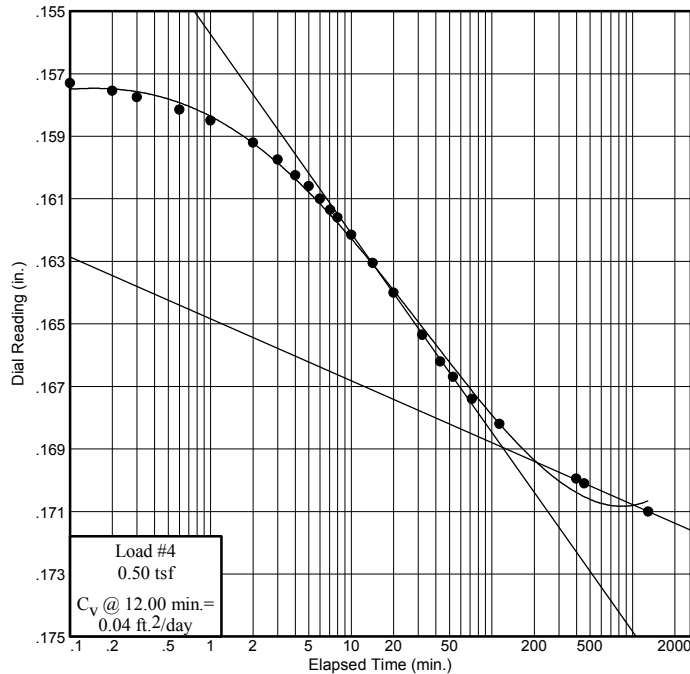
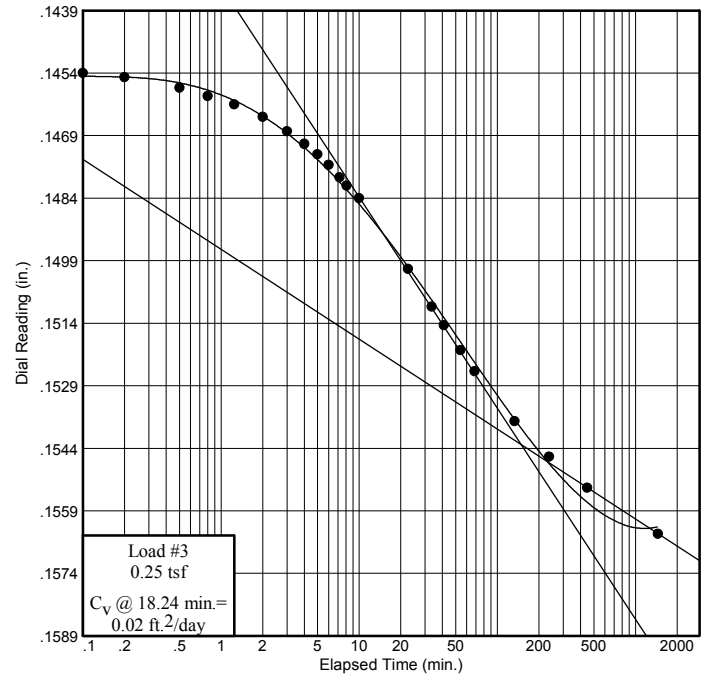
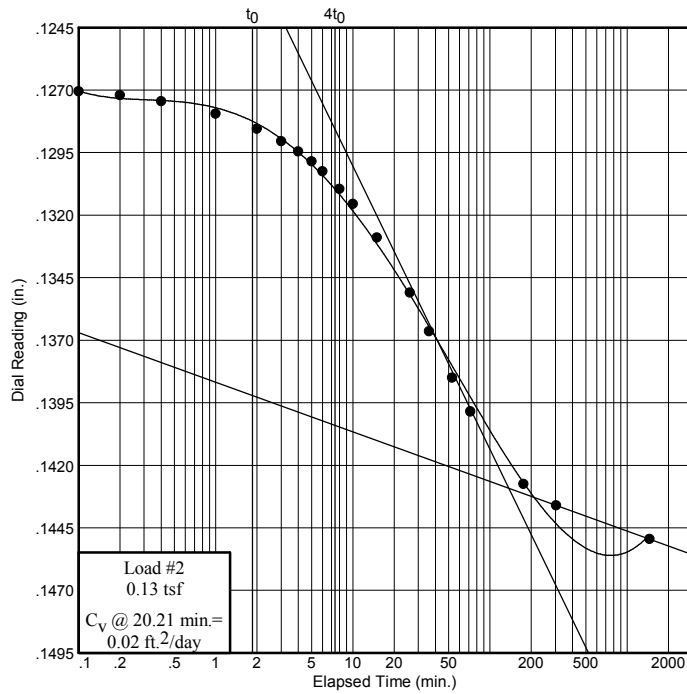
Project: TH 7 & Louisiana Ave Design

St. Louis Park, MN

Source:

Sample No.: E-3

Elev./Depth: 27-29'



BRAUN[™]
INTERTEC

Figure

Dial Reading vs. Time

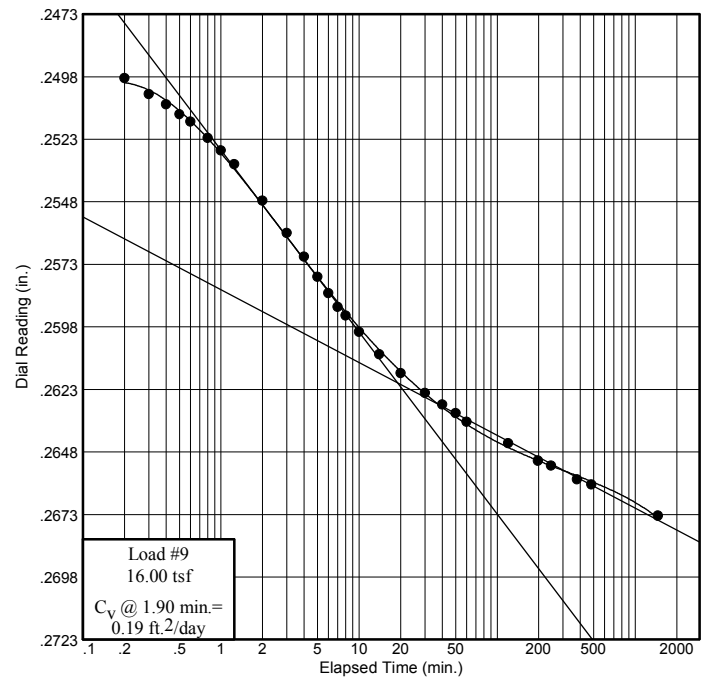
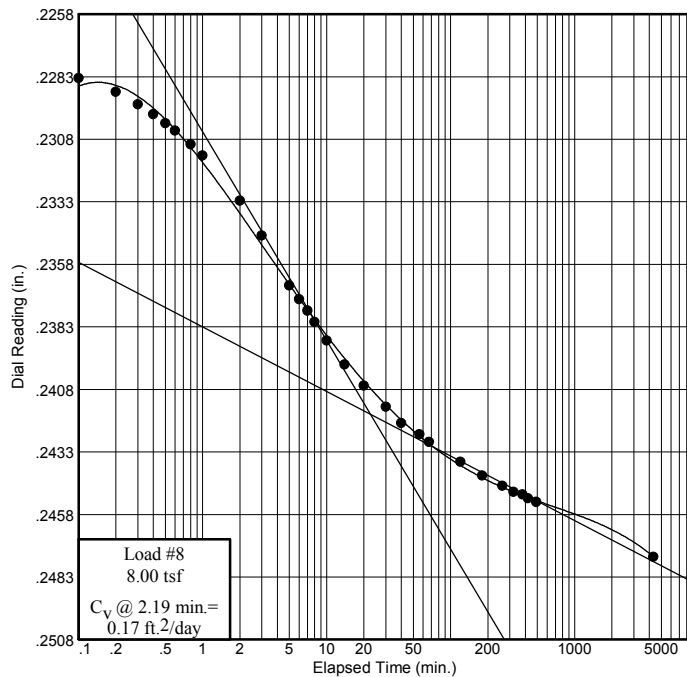
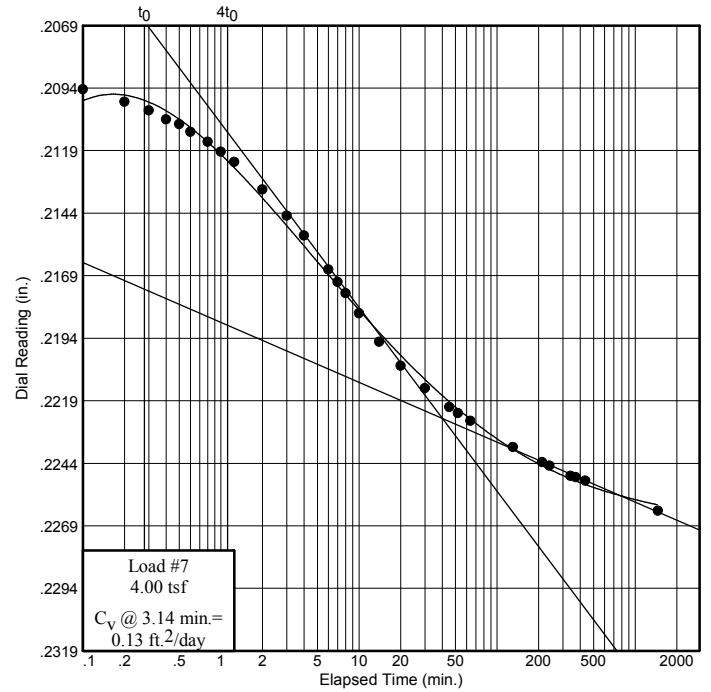
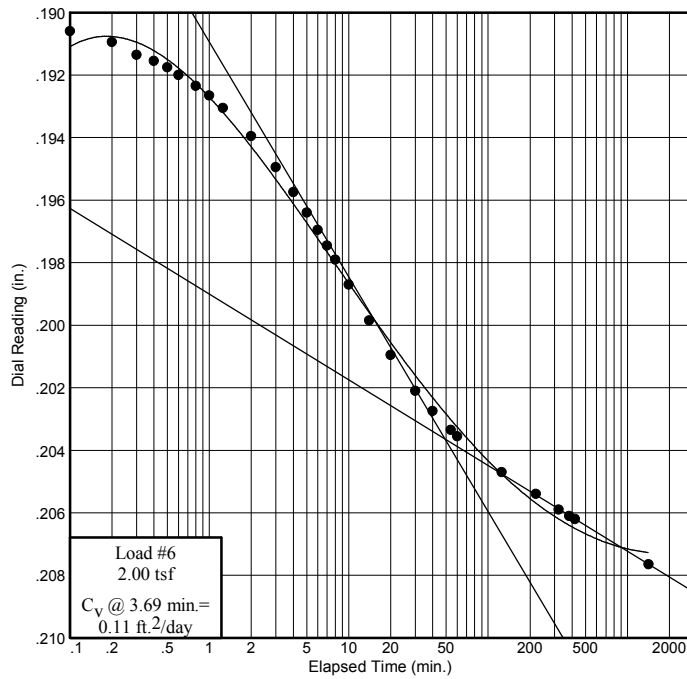
Project No.: BL0900745A

Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Source:

Sample No.: E-3

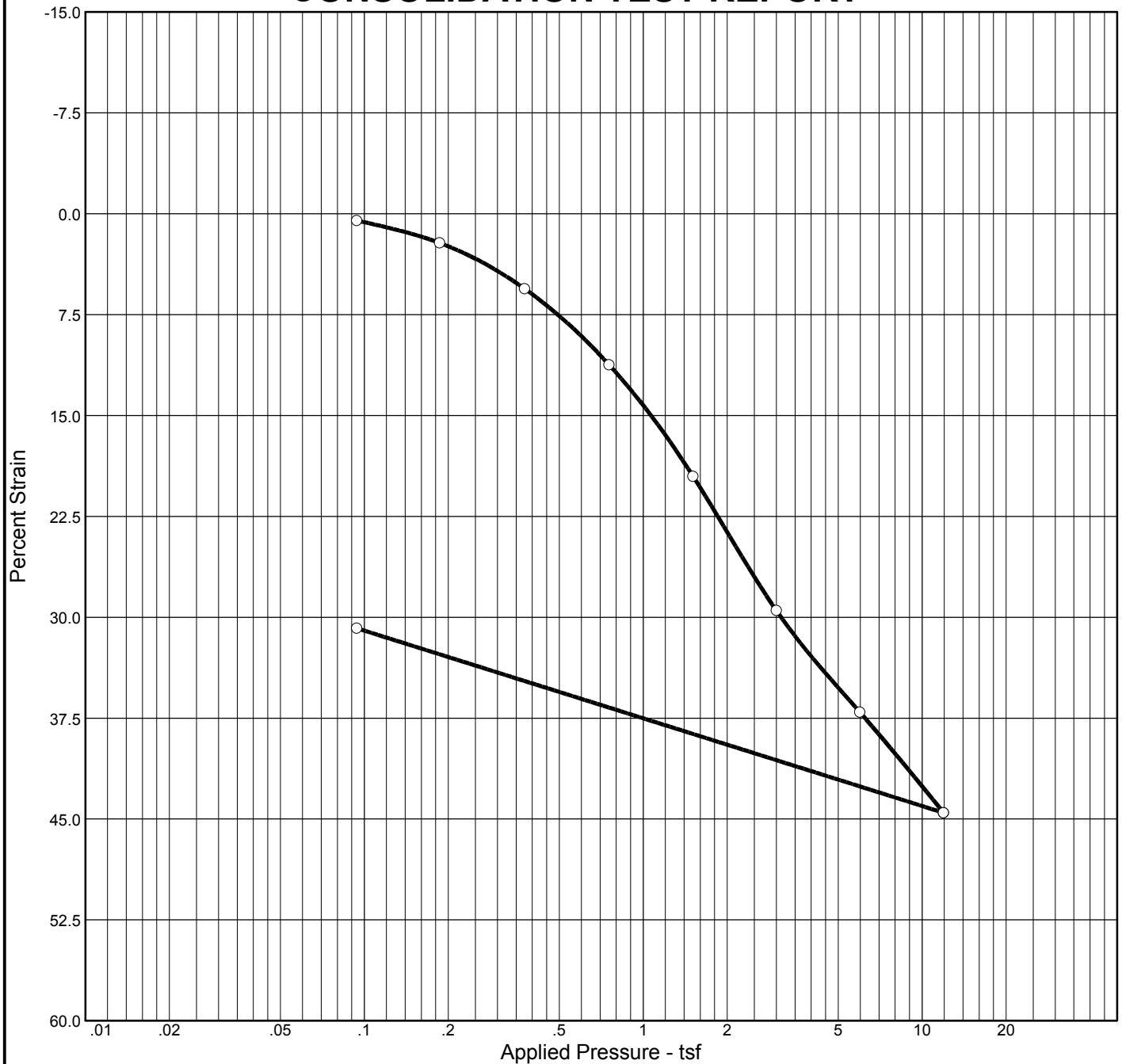
Elev./Depth: 27-29'



BRAUN[™]
INTERTEC

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P _c (tsf)	C _c	C _r	Swell Press. (tsf)	Swell %	e ₀
Sat.	Moist.											
93.3 %	128.9 %	35.2			2.55		0.65	1.33	0.29			3.521

MATERIAL DESCRIPTION										USCS	AASHTO
PEAT, brown (PT)											

Project No. BL0900745A Client: Short-Elliott-Hendrickson, Inc.			Remarks:
Project: TH 7 & Louisiana Ave Design St. Louis Park, MN			
Source:	Sample No.: R-8	Elev./Depth: 12-14'	
<div>BRAUNSM</div> <div>INTERTEC</div>			Figure

Figure

Dial Reading vs. Time

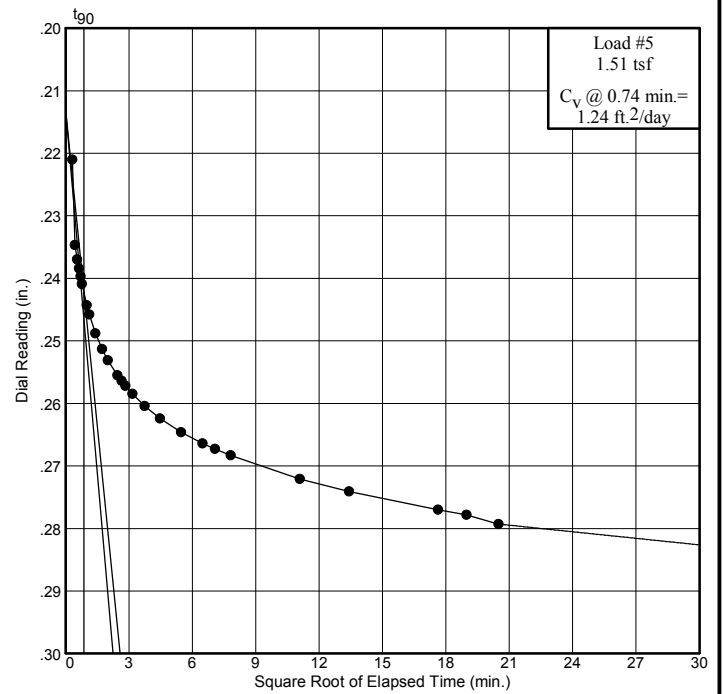
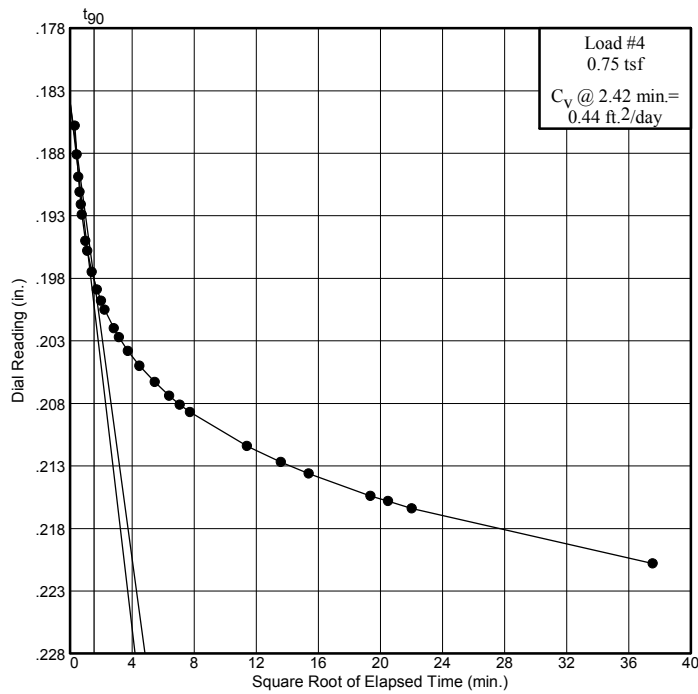
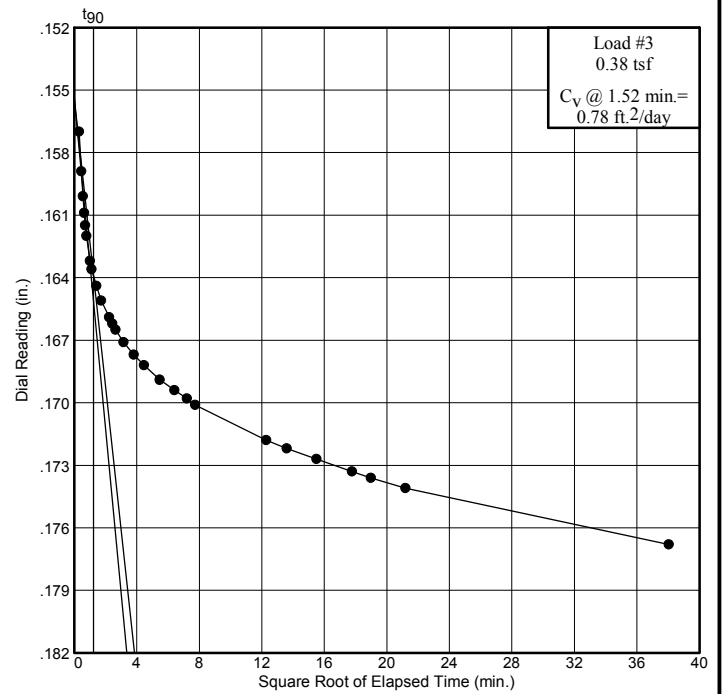
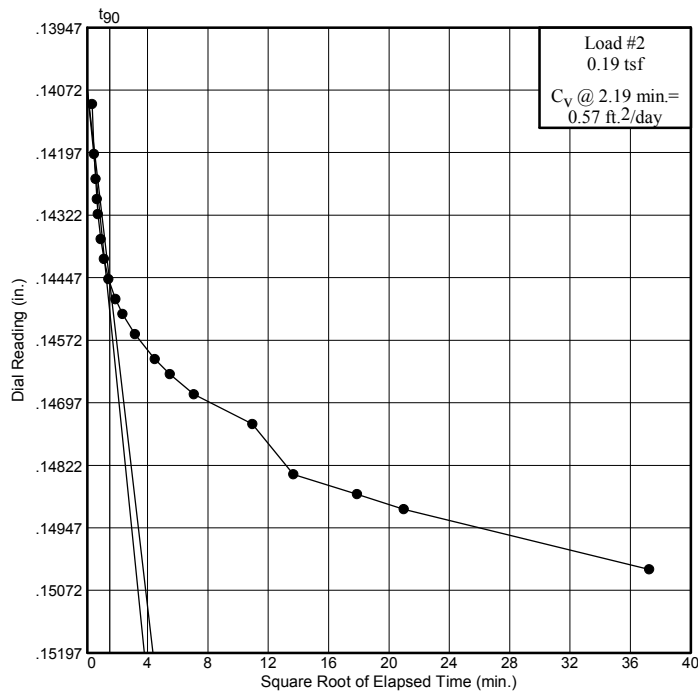
Project No.: BL0900745A

Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Source:

Sample No.: R-8

Elev./Depth: 12-14'



BRAUN[™]
INTERTEC

Figure

Dial Reading vs. Time

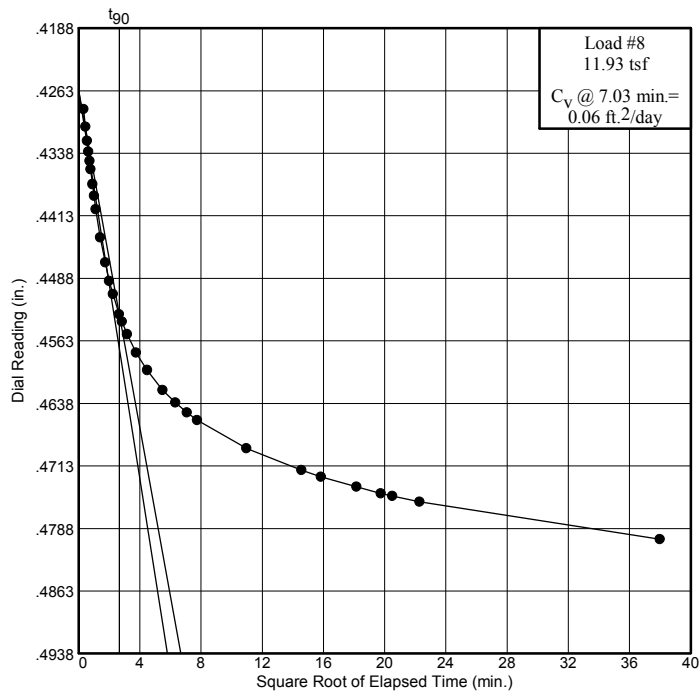
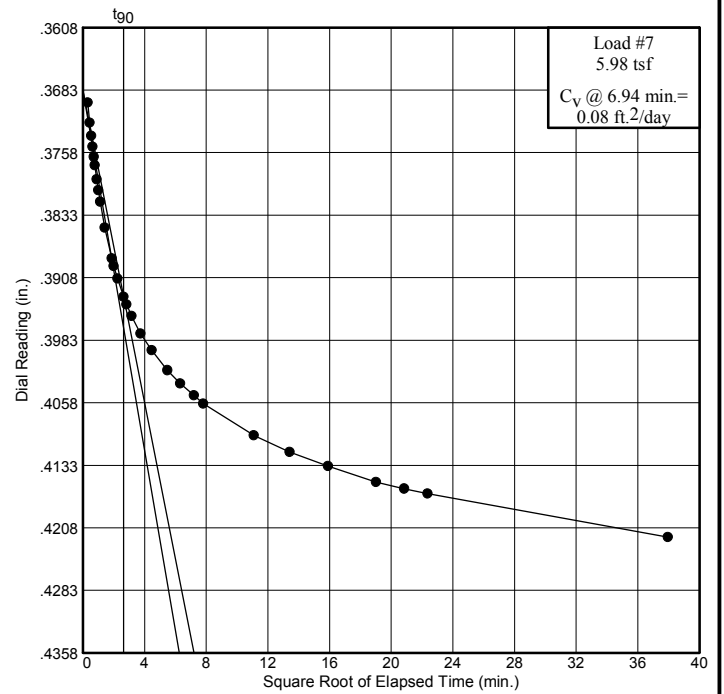
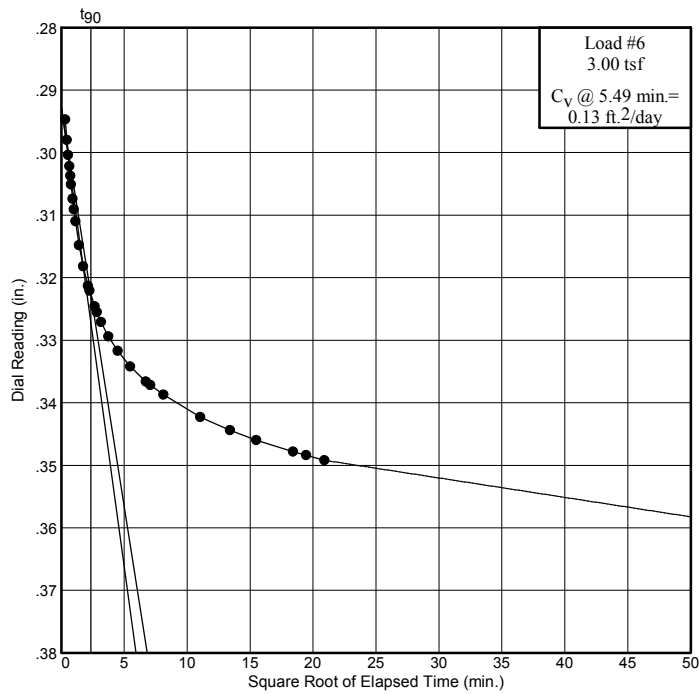
Project No.: BL0900745A

Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Source:

Sample No.: R-8

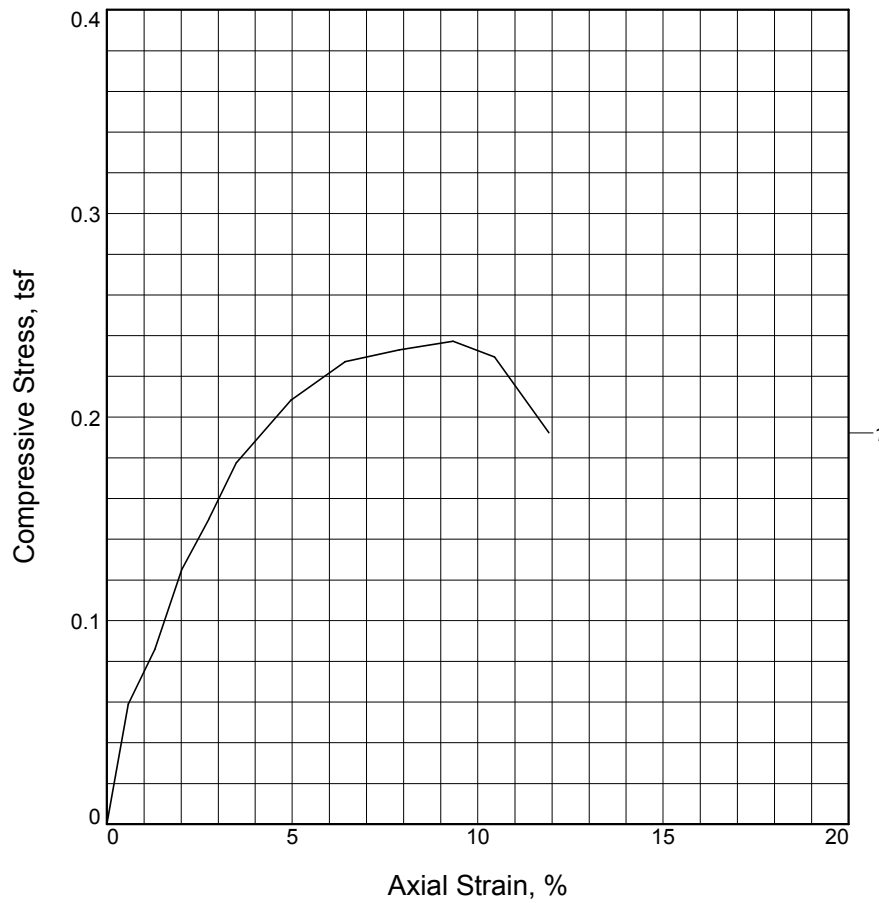
Elev./Depth: 12-14'



BRAUN[™]
INTERTEC

Figure

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.237			
Undrained shear strength, tsf	0.119			
Failure strain, %	9.3			
Strain rate, %/min.	1.00			
Water content, %	16.3			
Wet density, pcf	131.0			
Dry density, pcf	112.6			
Saturation, %	88.6			
Void ratio	0.4966			
Specimen diameter, in.	2.83			
Specimen height, in.	5.58			
Height/diameter ratio	1.97			

Description: CLAY, brown (C)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/18/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

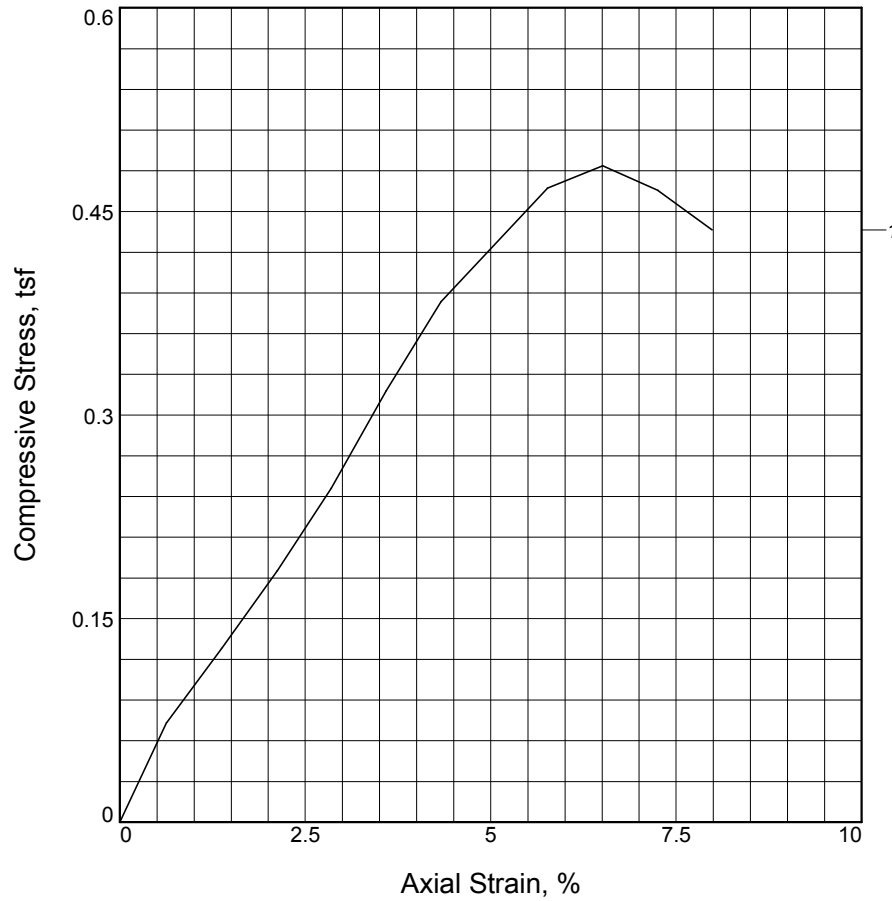
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: E-1 **Depth:** 15'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.484			
Undrained shear strength, tsf	0.242			
Failure strain, %	6.5			
Strain rate, %/min.	1.00			
Water content, %	47.5			
Wet density, pcf	106.1			
Dry density, pcf	71.9			
Saturation, %	95.5			
Void ratio	1.3433			
Specimen diameter, in.	2.83			
Specimen height, in.	5.57			
Height/diameter ratio	1.97			

Description: SILTY CLAY LOAM, black (SiCL)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/18/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

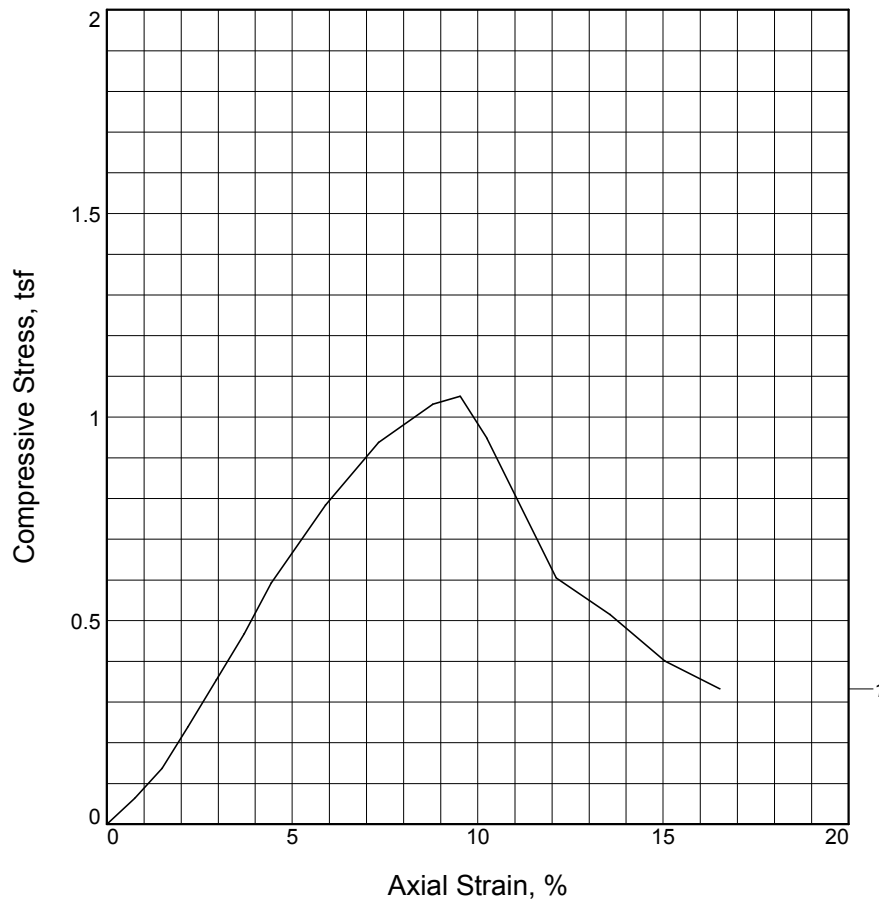
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: E-2 **Depth:** 20'

BRAUNSM
INTERTEC

Figure _____

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.051			
Undrained shear strength, tsf	0.526			
Failure strain, %	9.5			
Strain rate, %/min.	1.00			
Water content, %	22.7			
Wet density, pcf	129.6			
Dry density, pcf	105.6			
Saturation, %	99.8			
Void ratio	0.6258			
Specimen diameter, in.	2.82			
Specimen height, in.	5.58			
Height/diameter ratio	1.98			

Description: CLAY, brown (C)

LL = **PL =** **PI =** **GS= 2.75** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/17/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

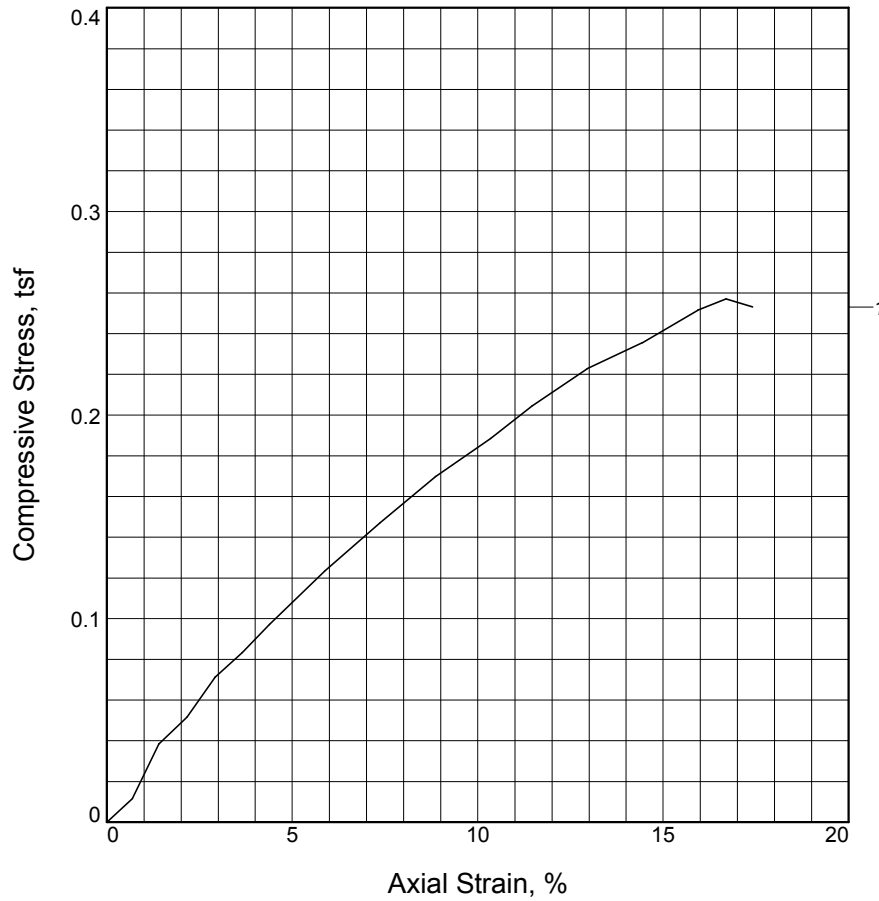
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: E-3 **Depth:** 22-24'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.257			
Undrained shear strength, tsf	0.129			
Failure strain, %	16.7			
Strain rate, %/min.	1.00			
Water content, %	26.8			
Wet density, pcf	123.8			
Dry density, pcf	97.7			
Saturation, %	99.6			
Void ratio	0.7255			
Specimen diameter, in.	2.85			
Specimen height, in.	5.51			
Height/diameter ratio	1.94			

Description: CLAY, black and gray (C)

LL = **PL =** **PI =** **GS= 2.7** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/17/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

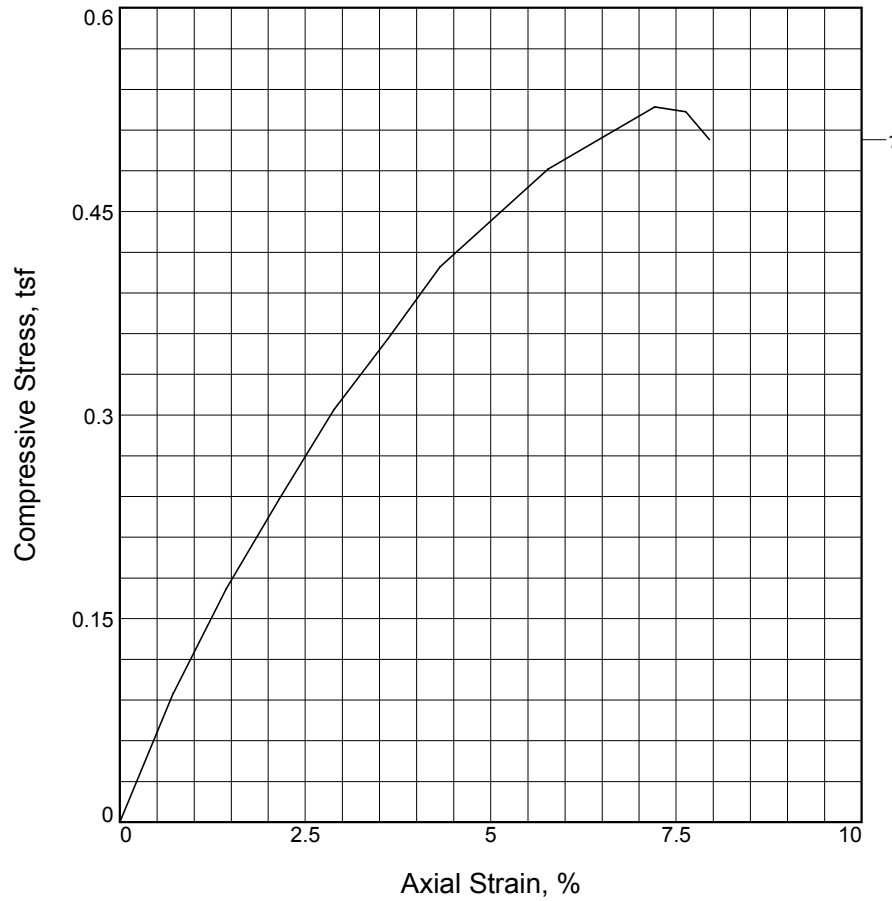
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: E-3 **Depth:** 27-29'

BRAUNSM
INTERTEC

Figure _____

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.527			
Undrained shear strength, tsf	0.263			
Failure strain, %	7.2			
Strain rate, %/min.	1.00			
Water content, %	225.2			
Wet density, pcf	70.1			
Dry density, pcf	21.6			
Saturation, %	89.2			
Void ratio	6.8189			
Specimen diameter, in.	2.80			
Specimen height, in.	5.60			
Height/diameter ratio	2.00			

Description: PEAT, brown (PT)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/3/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

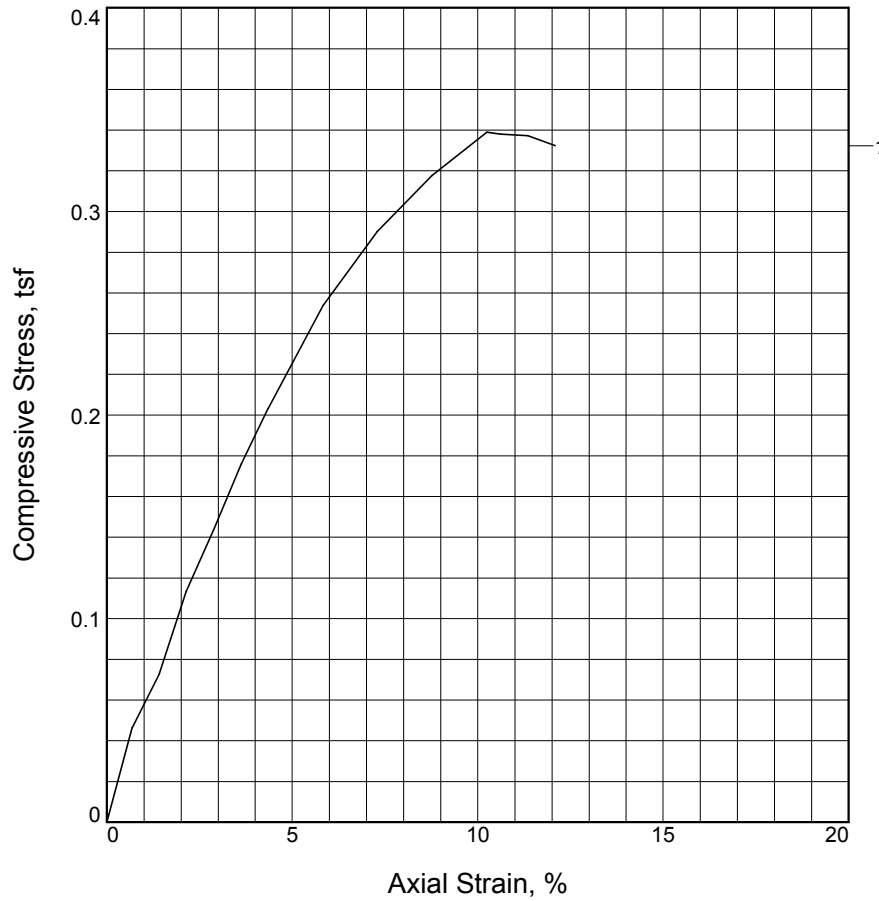
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-2 **Depth:** 14.5-16.5'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.339			
Undrained shear strength, tsf	0.169			
Failure strain, %	10.2			
Strain rate, %/min.	1.00			
Water content, %	20.1			
Wet density, pcf	131.3			
Dry density, pcf	109.3			
Saturation, %	100.0			
Void ratio	0.5419			
Specimen diameter, in.	2.83			
Specimen height, in.	5.53			
Height/diameter ratio	1.95			

Description: SILT, brown (ML)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/3/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

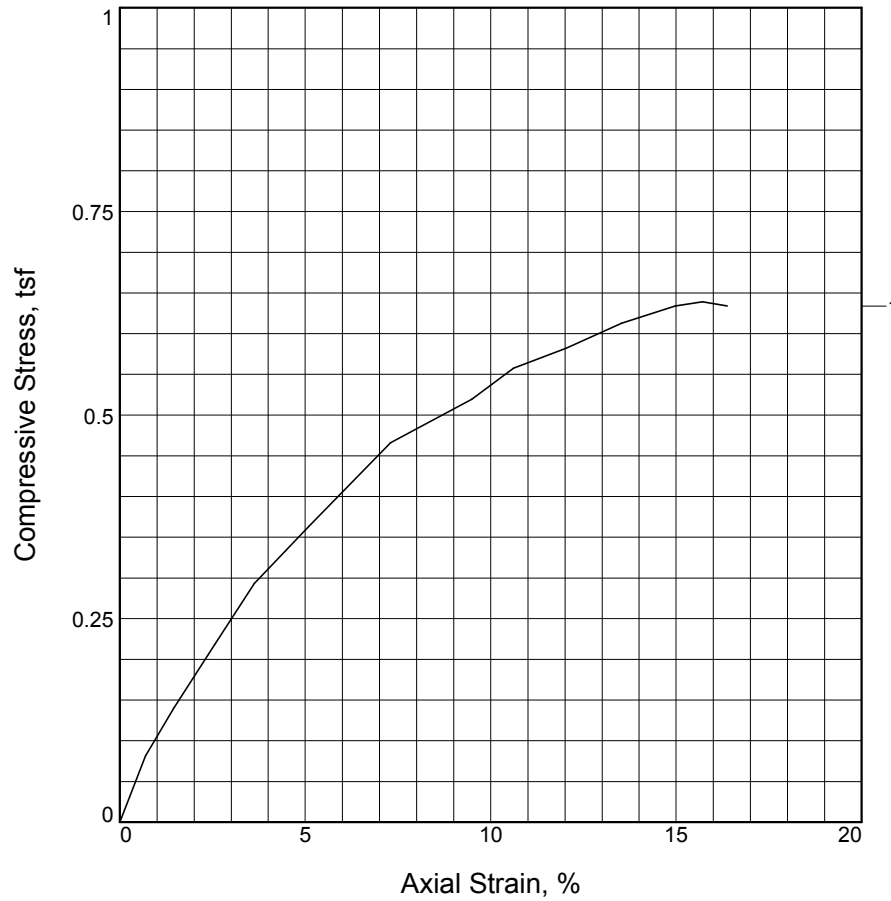
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-2 **Depth:** 19.5-21.5'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.639			
Undrained shear strength, tsf	0.319			
Failure strain, %	15.7			
Strain rate, %/min.	1.00			
Water content, %	359.1			
Wet density, pcf	65.3			
Dry density, pcf	14.2			
Saturation, %	89.4			
Void ratio	10.8424			
Specimen diameter, in.	2.83			
Specimen height, in.	5.56			
Height/diameter ratio	1.96			

Description: PEAT, brown (PT)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/8/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

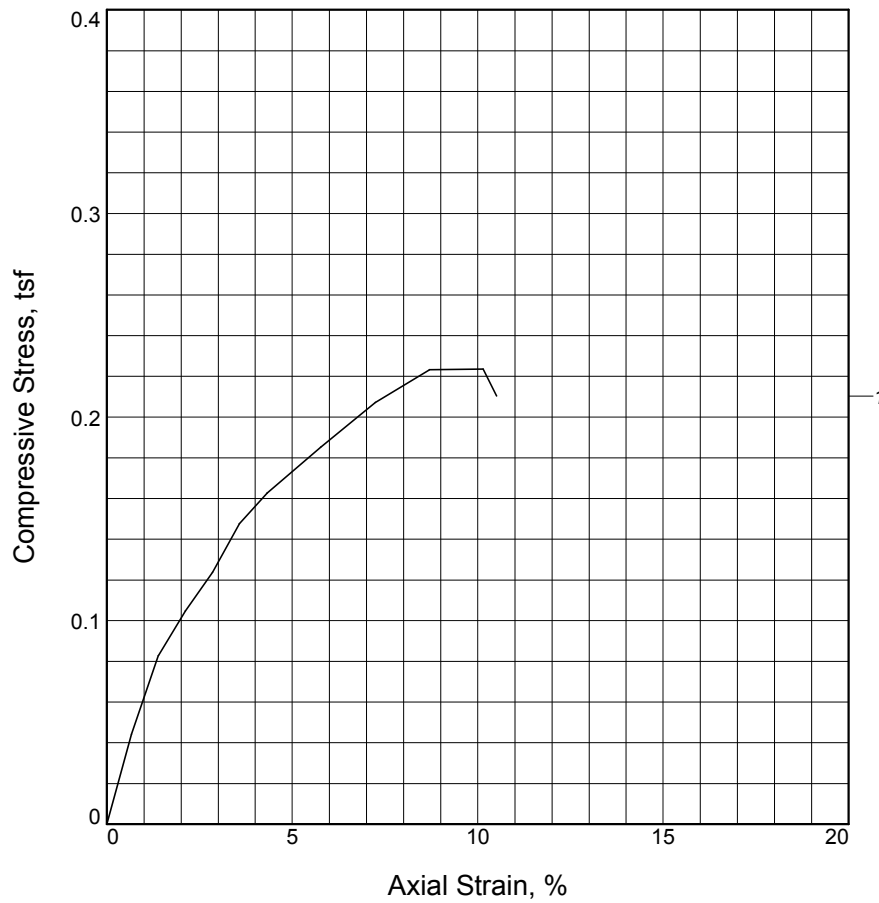
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-3 **Depth:** 9.5-11.5'

BRAUNSM
INTERTEC

Figure _____

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.224			
Undrained shear strength, tsf	0.112			
Failure strain, %	10.2			
Strain rate, %/min.	1.00			
Water content, %	179.0			
Wet density, pcf	72.3			
Dry density, pcf	25.9			
Saturation, %	87.8			
Void ratio	5.5037			
Specimen diameter, in.	2.78			
Specimen height, in.	5.61			
Height/diameter ratio	2.02			

Description: PEAT, brown (PT)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/8/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

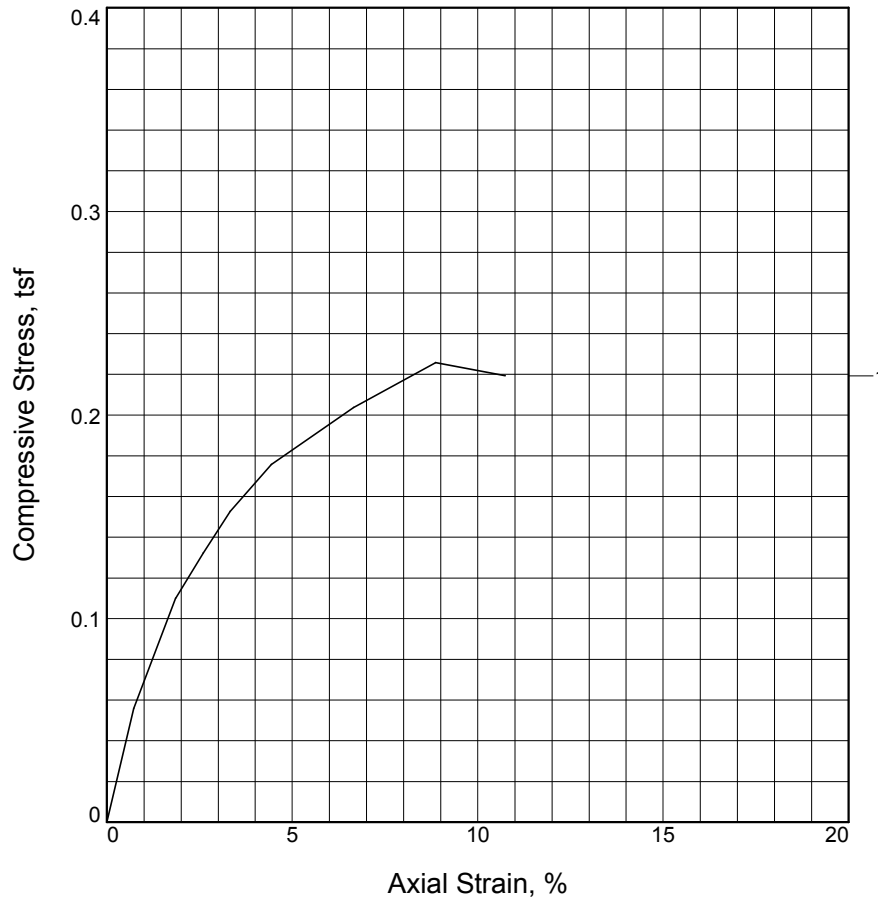
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-3 **Depth:** 14.5-16.5'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.226			
Undrained shear strength, tsf	0.113			
Failure strain, %	8.9			
Strain rate, %/min.	1.00			
Water content, %	84.1			
Wet density, pcf	92.2			
Dry density, pcf	50.1			
Saturation, %	95.9			
Void ratio	2.3676			
Specimen diameter, in.	2.80			
Specimen height, in.	5.53			
Height/diameter ratio	1.97			

Description: SILTY CLAY LOAM, gray (SiCL)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/8/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

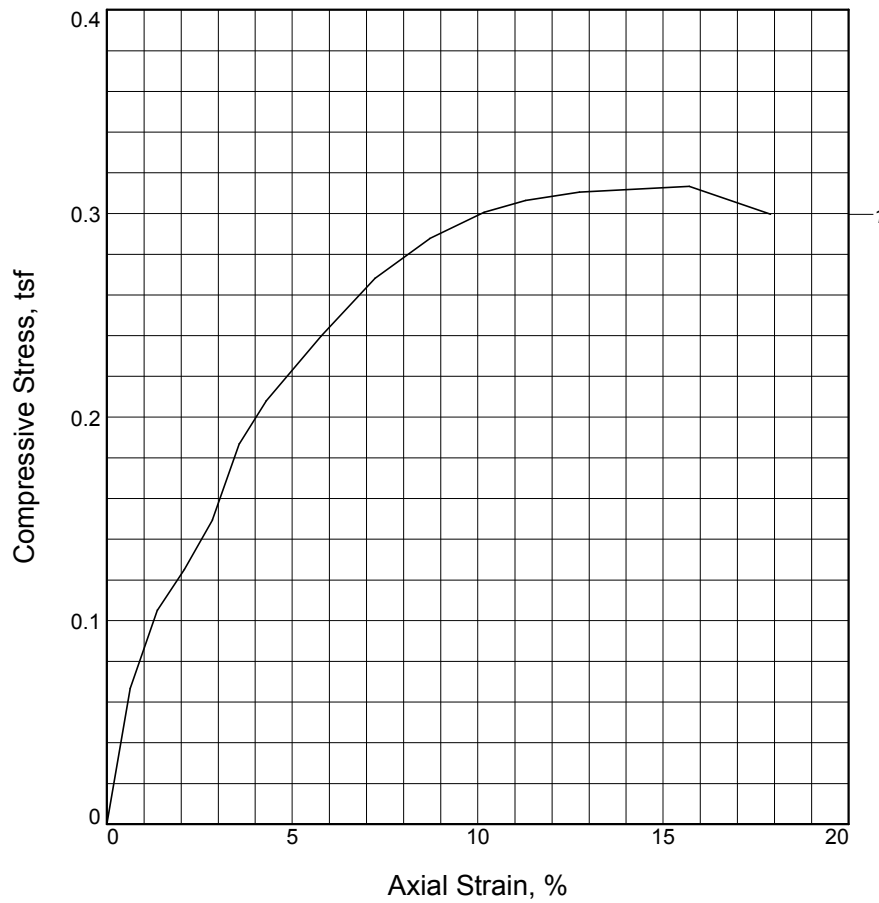
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-3 **Depth:** 19.5-21.5'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.313			
Undrained shear strength, tsf	0.157			
Failure strain, %	15.7			
Strain rate, %/min.	1.00			
Water content, %	79.0			
Wet density, pcf	93.0			
Dry density, pcf	51.9			
Saturation, %	95.0			
Void ratio	2.2455			
Specimen diameter, in.	2.79			
Specimen height, in.	5.58			
Height/diameter ratio	2.00			

Description: SILTY CLAY LOAM, gray (SiCL)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/13/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

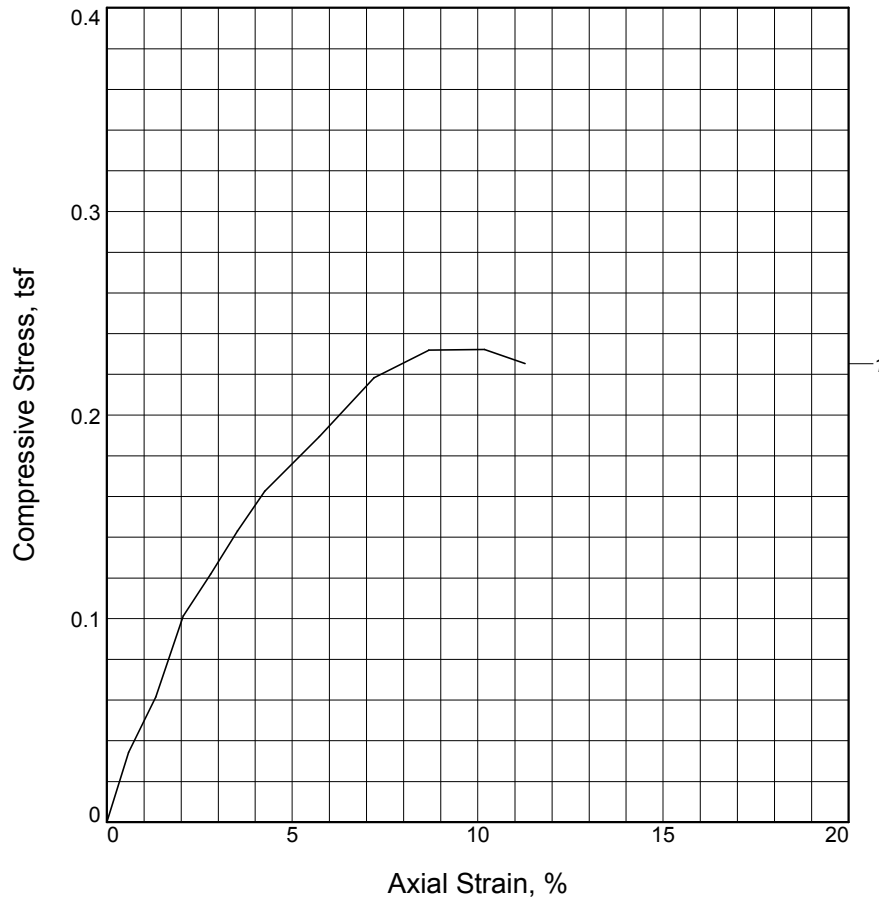
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-4 **Depth:** 29.5-31.5'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.232			
Undrained shear strength, tsf	0.116			
Failure strain, %	10.2			
Strain rate, %/min.	1.00			
Water content, %	144.1			
Wet density, pcf	81.2			
Dry density, pcf	33.3			
Saturation, %	95.7			
Void ratio	4.0682			
Specimen diameter, in.	2.84			
Specimen height, in.	5.53			
Height/diameter ratio	1.95			

Description: CLAY, gray (C)

LL =	PL =	PI =	GS= 2.70	Type: Thinwall
-------------	-------------	-------------	-----------------	-----------------------

Project No.: BL0900745A

Date Sampled: 6/13/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

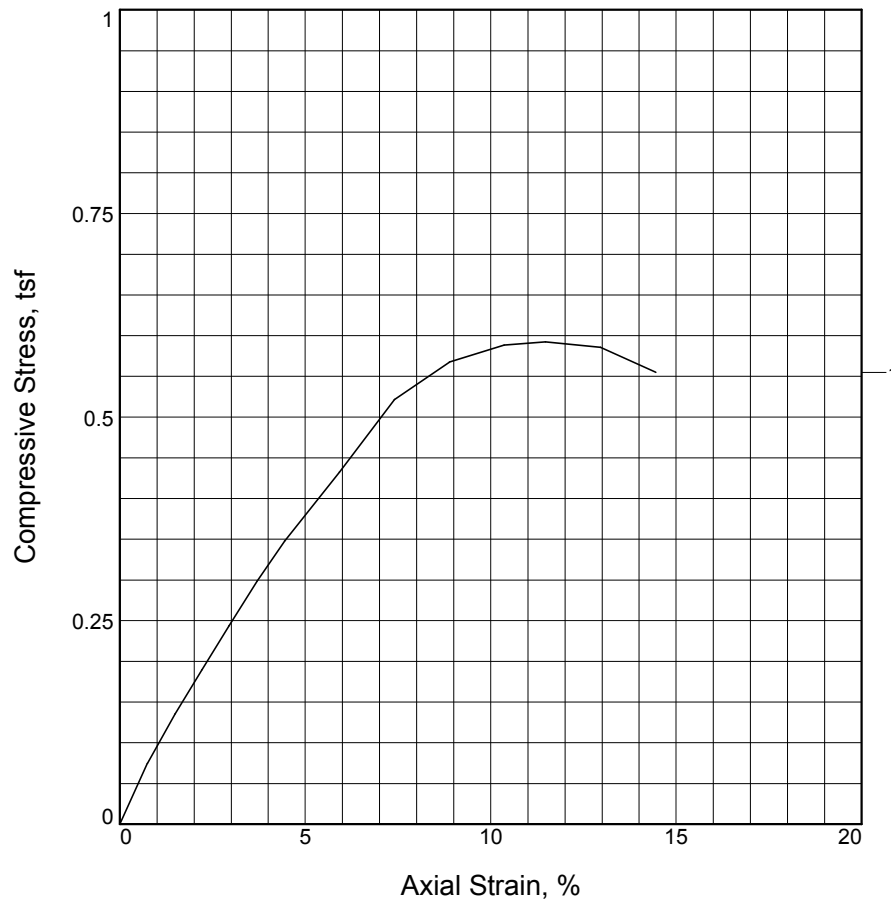
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-6 **Depth:** 19.5-21.5'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.592			
Undrained shear strength, tsf	0.296			
Failure strain, %	11.5			
Strain rate, %/min.	1.00			
Water content, %	22.2			
Wet density, pcf	130.3			
Dry density, pcf	106.7			
Saturation, %	100.0			
Void ratio	0.6096			
Specimen diameter, in.	2.82			
Specimen height, in.	5.55			
Height/diameter ratio	1.97			

Description: CLAY, gray (C)

LL =

PL =

PI =

GS= 2.75

Type: Thinwall

Project No.: BL0900745A

Date Sampled: 6/13/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

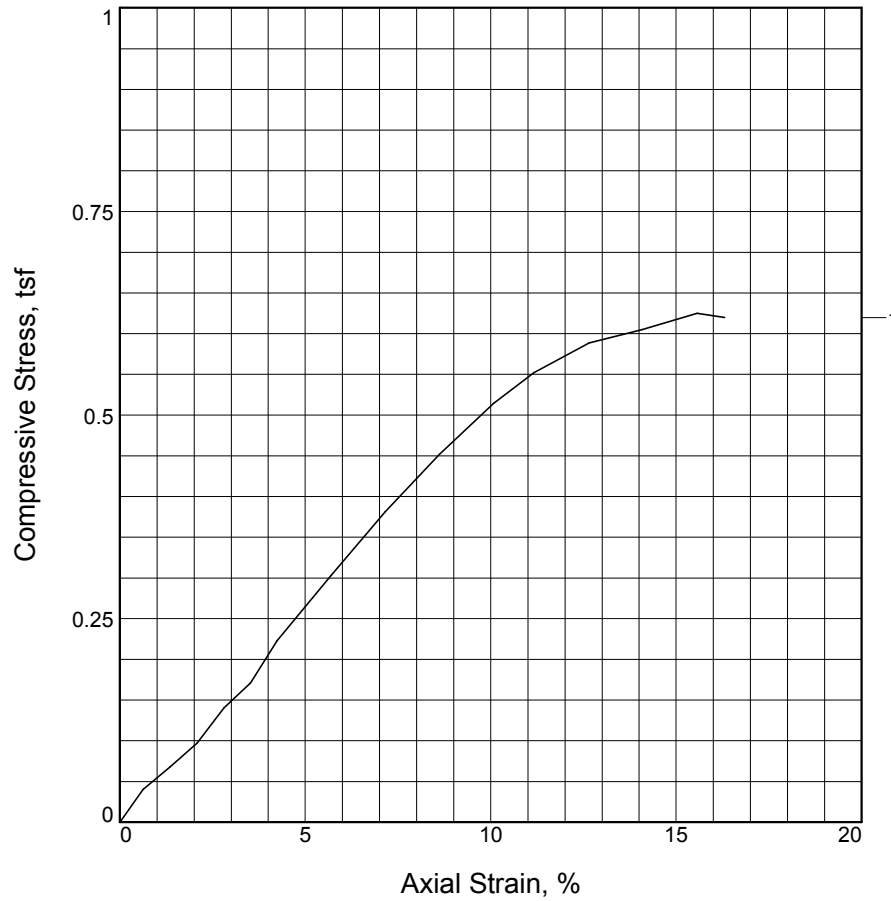
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-6 **Depth:** 24.5-26.5'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.625			
Undrained shear strength, tsf	0.312			
Failure strain, %	15.6			
Strain rate, %/min.	1.00			
Water content, %	24.7			
Wet density, pcf	124.0			
Dry density, pcf	99.5			
Saturation, %	96.0			
Void ratio	0.6948			
Specimen diameter, in.	2.83			
Specimen height, in.	5.62			
Height/diameter ratio	1.98			

Description: SILTY CLAY LOAM, brown (SiCL)

LL = **PL =** **PI =** **GS= 2.7** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/10/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

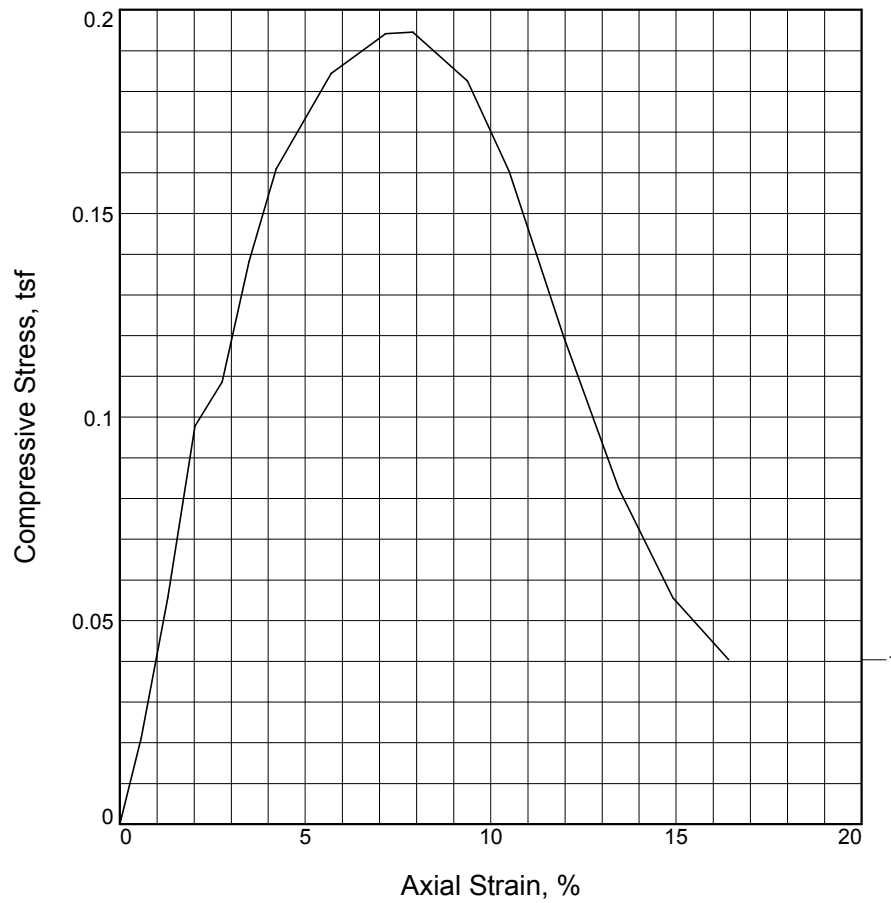
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-7 **Depth:** 19-21'

BRAUNSM
INTERTEC

Figure _____

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.195			
Undrained shear strength, tsf	0.097			
Failure strain, %	7.9			
Strain rate, %/min.	1.00			
Water content, %	36.3			
Wet density, pcf	113.6			
Dry density, pcf	83.4			
Saturation, %	95.8			
Void ratio	1.0213			
Specimen diameter, in.	2.83			
Specimen height, in.	5.56			
Height/diameter ratio	1.97			

Description: SILTY CLAY LOAM, gray (SiCL)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/10/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

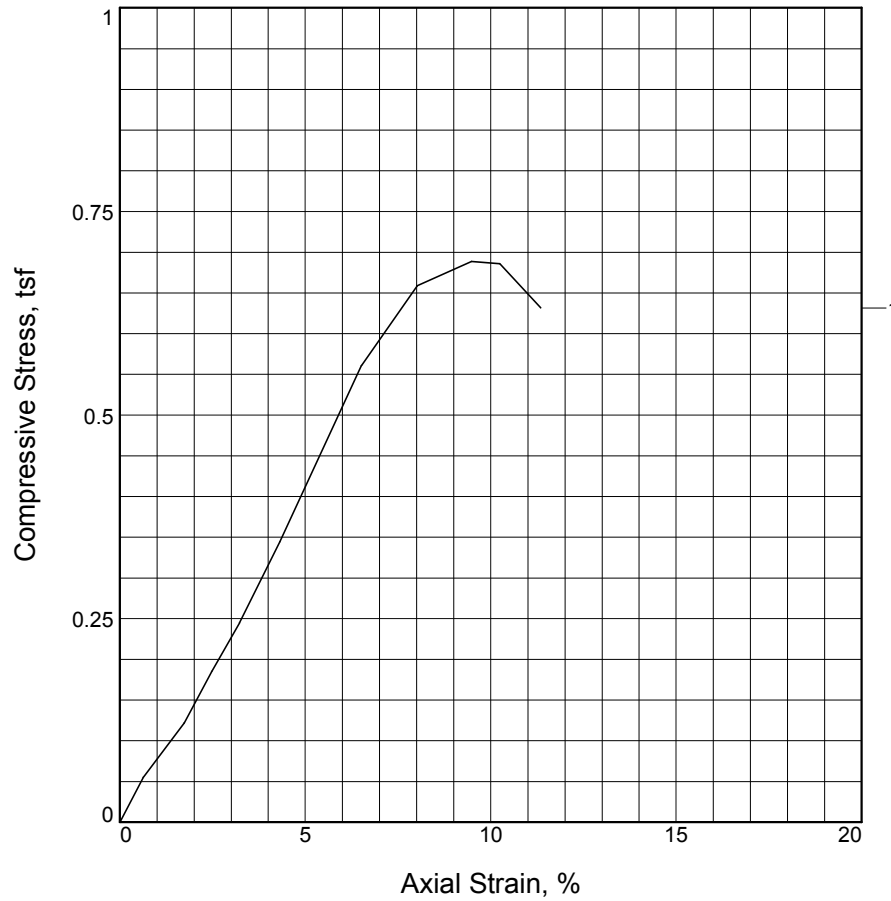
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-7 **Depth:** 24-26'

Figure _____

BRAUNSM
INTERTEC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.688			
Undrained shear strength, tsf	0.344			
Failure strain, %	9.5			
Strain rate, %/min.	1.00			
Water content, %	27.0			
Wet density, pcf	124.9			
Dry density, pcf	98.4			
Saturation, %	99.6			
Void ratio	0.7447			
Specimen diameter, in.	2.82			
Specimen height, in.	5.52			
Height/diameter ratio	1.96			

Description: SILTY CLAY LOAM, brown (SiCL)

LL = **PL =** **PI =** **GS= 2.75** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/9/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

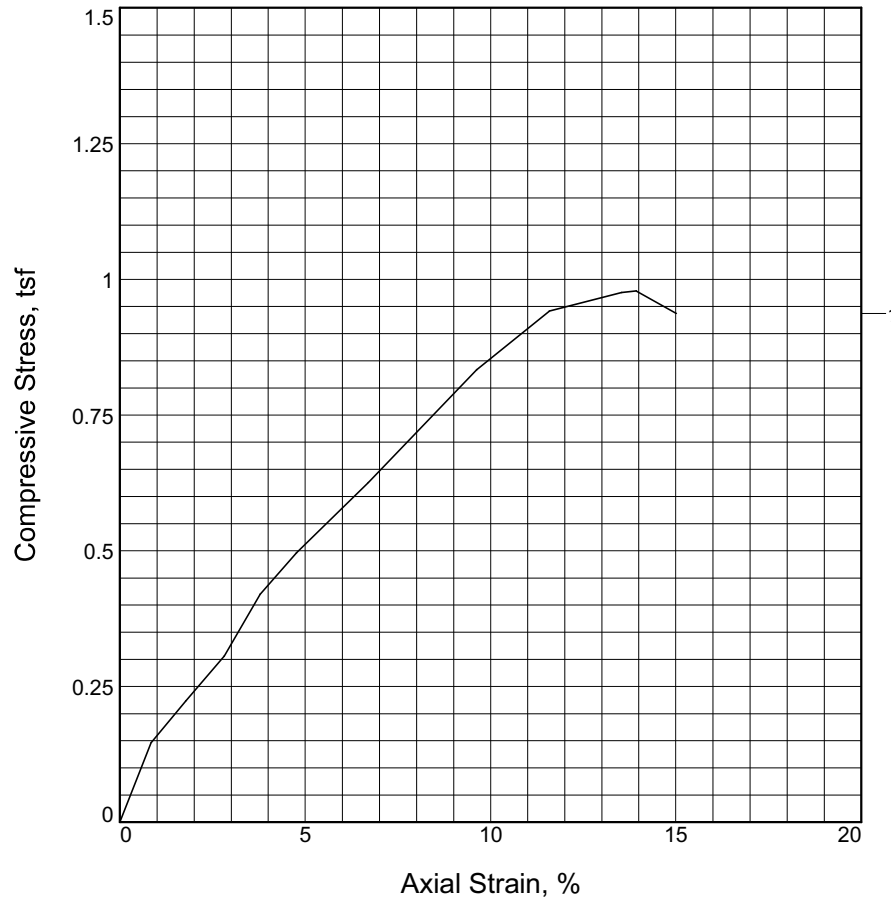
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-8 **Depth:** 22-24'

BRAUNSM
INTERTEC

Figure _____

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1		
Peak Stress, tsf	0.979		
Ult. Stress, tsf	0.937		
Cell pressure, tsf	1.100		
Strain rate, %/min.	1.00		
Water content, %	52.9		
Wet density, pcf	103.5		
Dry density, pcf	67.7		
Saturation, %	95.9		
Void ratio	1.4899		
Specimen diameter, in.	1.42		
Specimen height, in.	2.80		
Height/diameter ratio	1.98		

Description: SILTY CLAY LOAM, black (SiCL)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/18/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

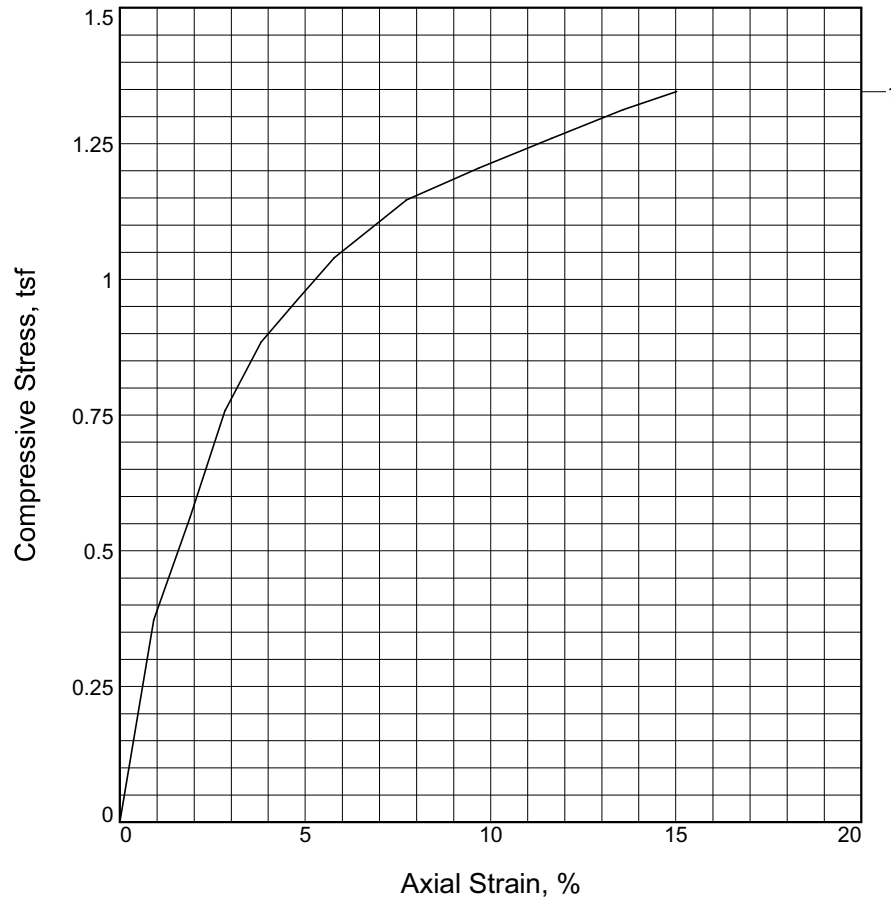
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: E-2 **Depth:** 20'

Figure UU Triax ASTM D 2850

BRAUNSM
INTERTEC

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Peak Stress, tsf	1.346			
Ult. Stress, tsf	1.346			
Cell pressure, tsf	1.500			
Strain rate, %/min.	1.00			
Water content, %	25.2			
Wet density, pcf	126.6			
Dry density, pcf	101.1			
Saturation, %	99.4			
Void ratio	0.6988			
Specimen diameter, in.	1.41			
Specimen height, in.	2.80			
Height/diameter ratio	1.99			

Description: CLAY, black and gray (C)

LL = **PL =** **PI =** **GS= 2.75** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/17/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

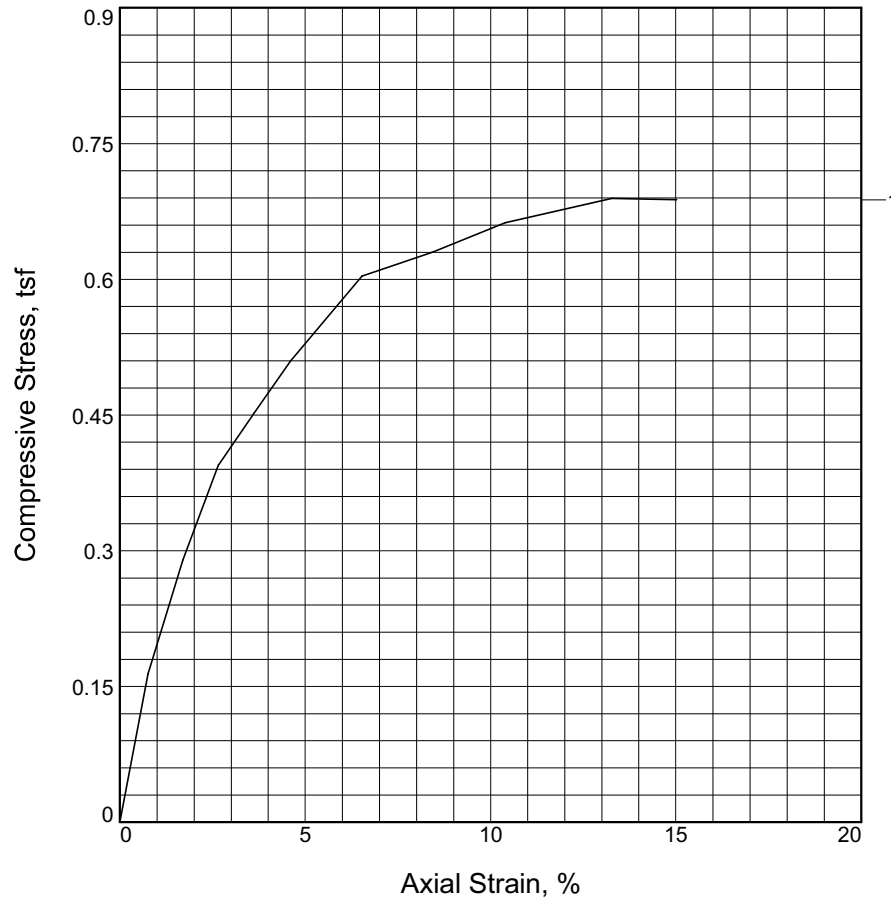
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: E-3 **Depth:** 22-24'

Figure UU Triax ASTM D 2850

BRAUNSM
INTERTEC

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Peak Stress, tsf	0.689			
Ult. Stress, tsf	0.688			
Cell pressure, tsf	0.650			
Strain rate, %/min.	1.00			
Water content, %	47.2			
Wet density, pcf	100.8			
Dry density, pcf	68.5			
Saturation, %	87.1			
Void ratio	1.4610			
Specimen diameter, in.	1.40			
Specimen height, in.	2.81			
Height/diameter ratio	2.00			

Description: PEAT, brown (PT)

LL =

PL =

PI =

GS= 2.70

Type: Thinwall

Project No.: BL0900745A

Date Sampled: 6/3/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

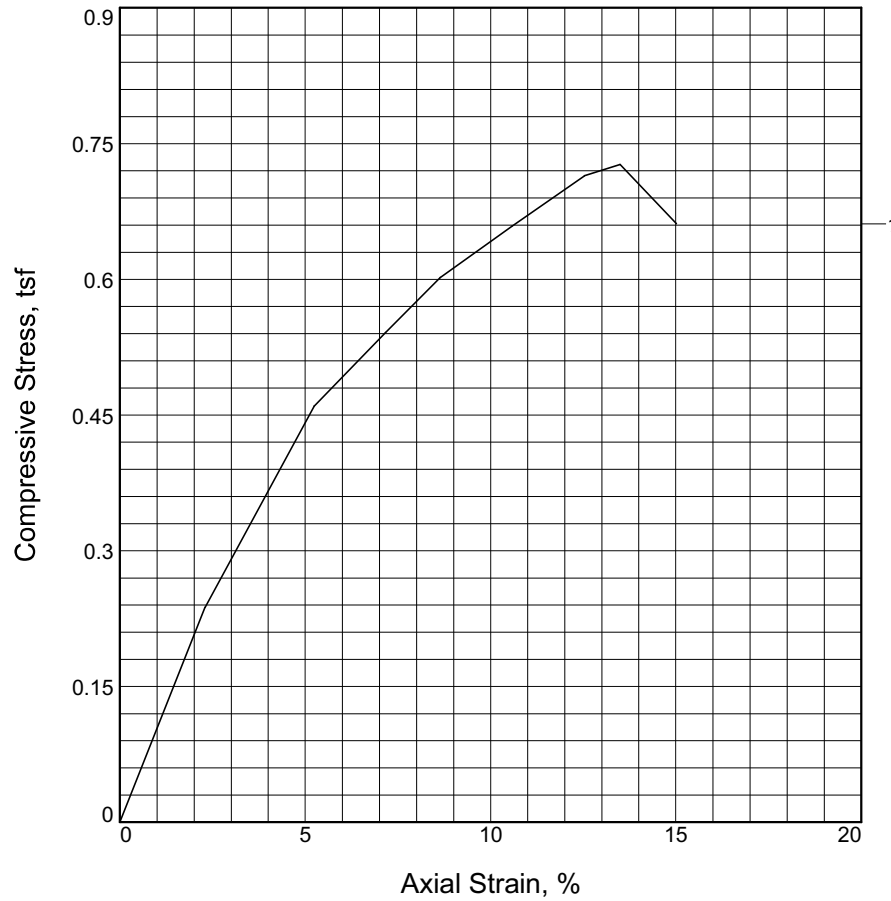
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-2 **Depth:** 9.5-11.5'

Figure UU Triax ASTM D 2850

BRAUN
INTERTEC

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1		
Peak Stress, tsf	0.727		
Ult. Stress, tsf	0.661		
Cell pressure, tsf	0.400		
Strain rate, %/min.	1.00		
Water content, %	393.0		
Wet density, pcf	66.7		
Dry density, pcf	13.5		
Saturation, %	92.6		
Void ratio	11.4593		
Specimen diameter, in.	1.41		
Specimen height, in.	2.79		
Height/diameter ratio	1.98		

Description: PEAT, brown (PT)

LL =	PL =	PI =	GS= 2.70	Type: Thinwall
-------------	-------------	-------------	-----------------	-----------------------

Project No.: BL0900745A

Date Sampled: 6/8/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

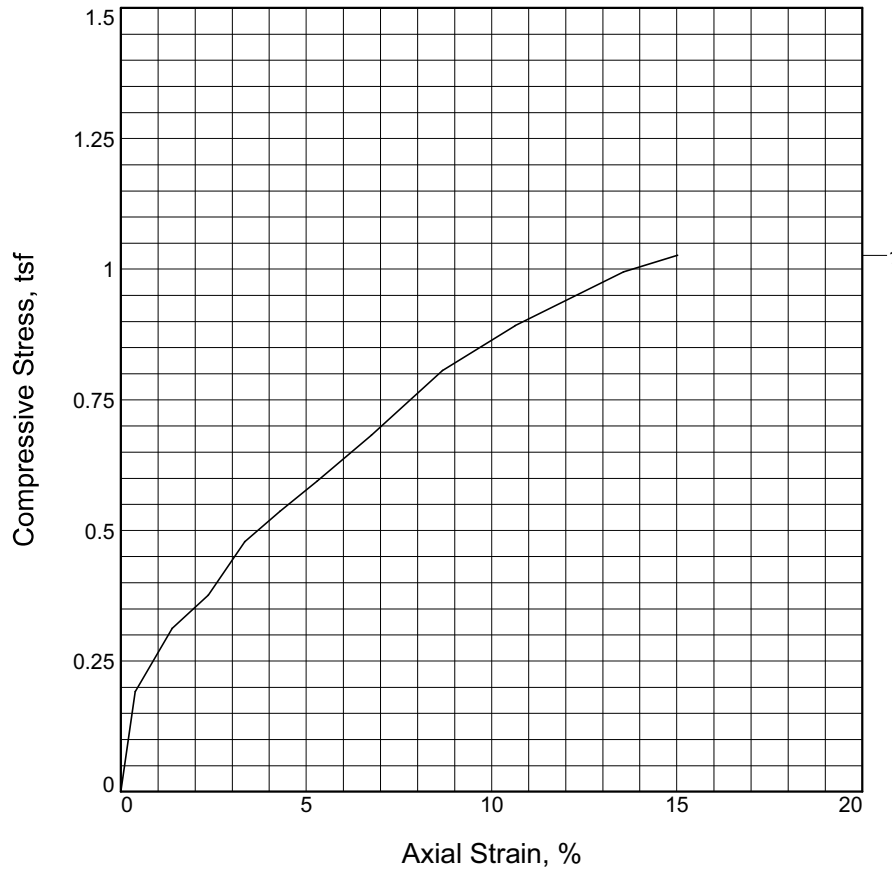
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-3 **Depth:** 9.5-11.5'

Figure UU Triax ASTMD 2850

BRAUNSM
INTERTEC

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Peak Stress, tsf	1.026			
Ult. Stress, tsf	1.026			
Cell pressure, tsf	1.250			
Strain rate, %/min.	1.00			
Water content, %	59.0			
Wet density, pcf	103.2			
Dry density, pcf	64.9			
Saturation, %	99.8			
Void ratio	1.5953			
Specimen diameter, in.	1.38			
Specimen height, in.	2.80			
Height/diameter ratio	2.02			

Description: SILTY CLAY LOAM, gray (SiCL)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 6/13/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

Project: TH 7 & Louisiana Ave Design

St. Louis Park, MN

Sample Number: R-4

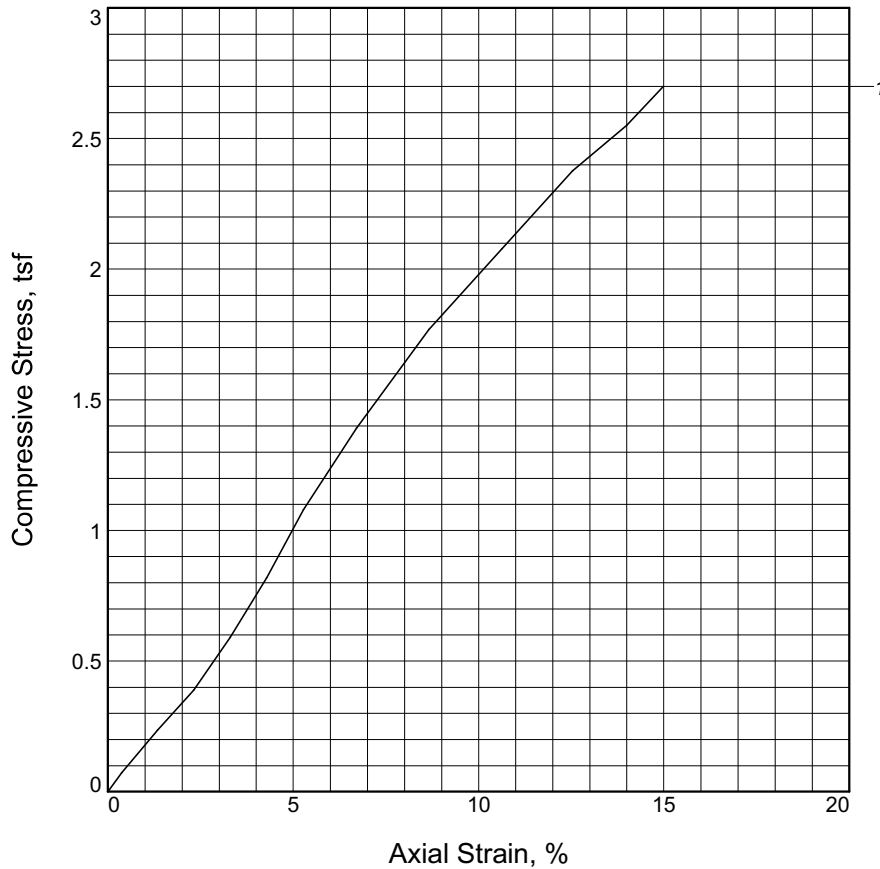
Depth: 29.5-31.5'

Figure UU Triax ASTM D 2850

BRAUNSM
INTERTEC

Tested By: jk **Checked By:** jrs

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Peak Stress, tsf	2.700			
Ult. Stress, tsf	2.700			
Cell pressure, tsf	1.000			
Strain rate, %/min.	1.00			
Water content, %	18.7			
Wet density, pcf	135.2			
Dry density, pcf	113.9			
Saturation, %	99.4			
Void ratio	0.5237			
Specimen diameter, in.	1.39			
Specimen height, in.	2.80			
Height/diameter ratio	2.02			

Description: SILTY CLAY LOAM, gray (SiCL)

LL = **PL =** **PI =** **GS= 2.78** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/10/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

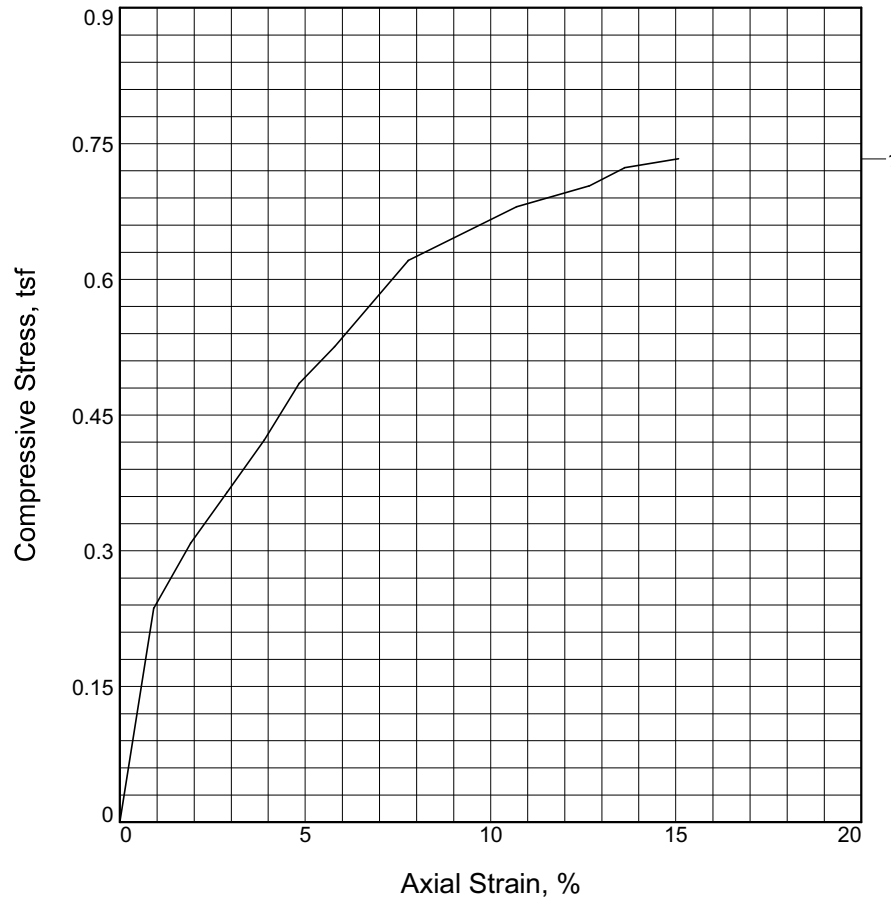
Sample Number: R-7 **Depth:** 19-21'

Figure UU Triax ASTM D 2850

BRAUNSM
INTERTEC

Tested By: jk **Checked By:** jrs

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1			
Peak Stress, tsf	0.733			
Ult. Stress, tsf	0.733			
Cell pressure, tsf	1.000			
Strain rate, %/min.	1.00			
Water content, %	31.5			
Wet density, pcf	118.3			
Dry density, pcf	89.9			
Saturation, %	97.4			
Void ratio	0.8744			
Specimen diameter, in.	1.39			
Specimen height, in.	2.81			
Height/diameter ratio	2.03			

Description: SILTY CLAY LOAM, gray (SiCL)

LL = **PL =** **PI =** **GS= 2.7** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/10/11

Remarks:

Client: Short-Elliott-Hendrickson, Inc.

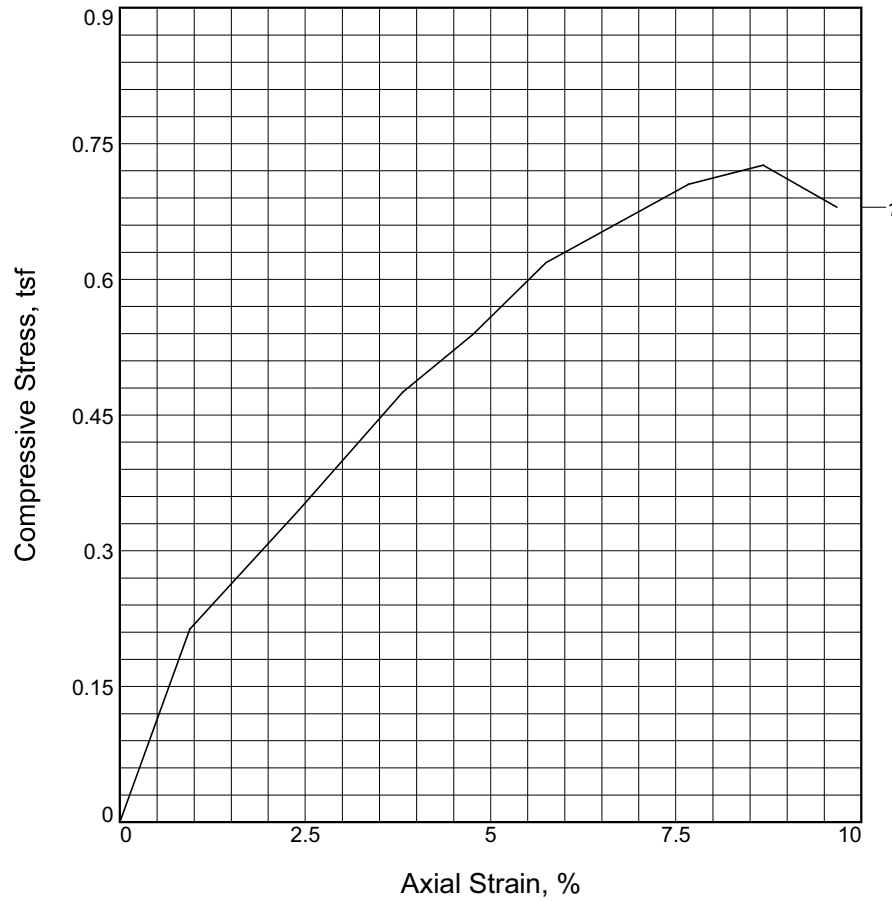
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-7 **Depth:** 24-26'

Figure UU Triax ASTM D 2850

BRAUNSM
INTERTEC

UNCONSOLIDATED UNDRAINED TEST



Sample No.	1		
Peak Stress, tsf	0.726		
Ult. Stress, tsf	0.680		
Cell pressure, tsf	1.000		
Strain rate, %/min.	1.00		
Water content, %	264.4		
Wet density, pcf	65.4		
Dry density, pcf	18.0		
Saturation, %	85.1		
Void ratio	8.3870		
Specimen diameter, in.	1.40		
Specimen height, in.	2.78		
Height/diameter ratio	1.98		

Description: PEAT, brown (PT)

LL = **PL =** **PI =** **GS= 2.70** **Type:** Thinwall

Project No.: BL0900745A

Date Sampled: 5/25/11

Remarks:

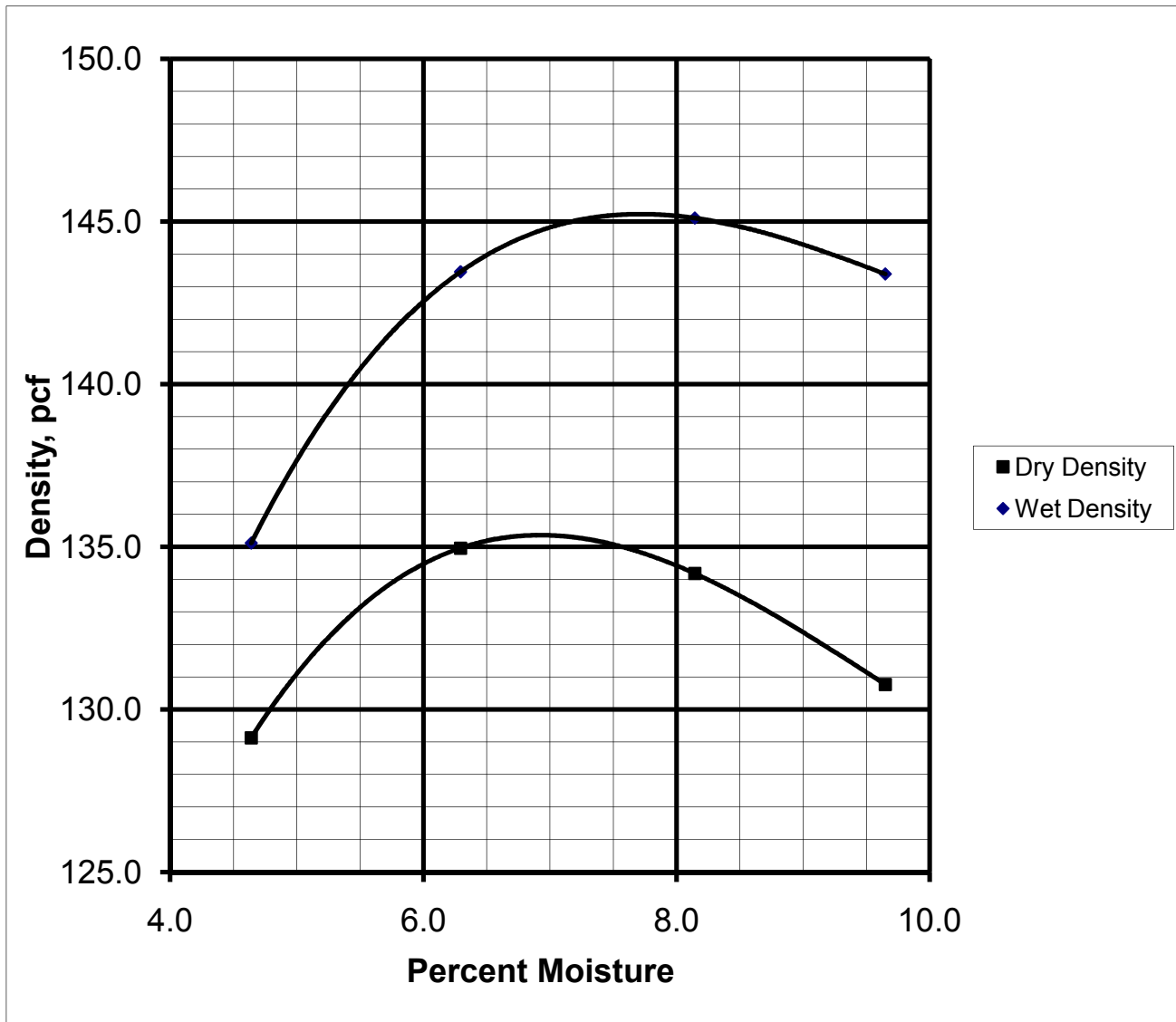
Client: Short-Elliott-Hendrickson, Inc.

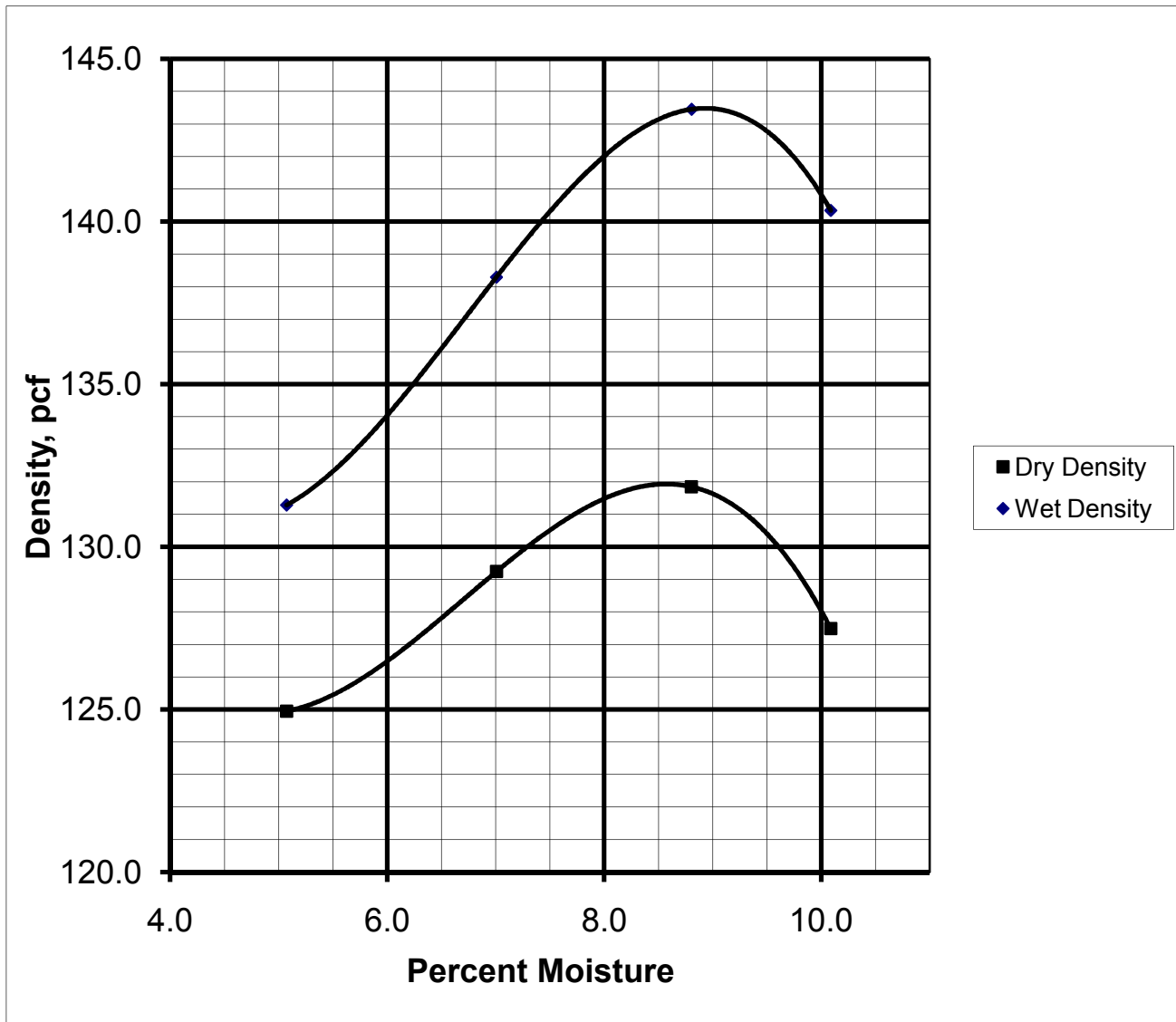
Project: TH 7 & Louisiana Ave Design
St. Louis Park, MN

Sample Number: R-9 **Depth:** 14.5-16.5'

Figure UU Triax ASTM D 2850

BRAUNSM
INTERTEC

Moisture-Density RelationshipSP No: _____ Date: 7/8/2011 Tester: 13733
Curve No: P-01 Soil Class: Loamy SandOptimum Moisture: 6.9 % Maximum Density: 135.4 pcf
Sample Location: Boring B-13, Boring B-13, 1-3ft

Moisture-Density RelationshipSP No: _____ Date: 7/8/2011 Tester: 13733
Curve No: P-02 Soil Class: Sandy LoamOptimum Moisture: 8.6 % Maximum Density: 131.9 pcf
Sample Location: Boring B-3, Boring B-3, 1-5ft

Material Test Report

Minneapolis Laboratory
Braun Intertec Corporation
Phone: 952-995-2000

Report No: MAT:W11-001210-S2

Issue No: 1

Client: Brent Theroux
Short-Elliott-Hendrickson, Incorporated
3535 Vadnais Center Dr
Saint Paul, MN, 55110-5196
Project: BL-09-00745A
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, MN, 55426
PM: Josh J VanAbel, jvanabel@BraunIntertec.com



Dallas Miner

Laboratory Supervisor

Date of Issue: 7/13/2011

Sample Details

Sample ID: W11-001210-S2
Alternate Sample ID:
Sampled By: Scott Mclean
Sampling Method: Soil Boring Auger
Date Sampled: 5/18/2011
Date Submitted: 7/7/2011
Specification:
Source: Boring B-3, 1-5 ft
Material Type: Sandy Loam
Sample Location: Boring B-3

Test Results

Description	Method	Result	Limits
R Value	MnDOT 1307 - 95	28	
Date Tested		7/12/2011	
Certification #s		15600	
Date Tested		7/12/2011	

Comments

N/A

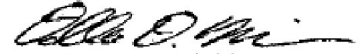
Material Test Report

Minneapolis Laboratory
Braun Intertec Corporation
Phone: 952-995-2000

Report No: MAT:W11-001210-S1

Issue No: 1

Client: Brent Theroux
Short-Elliott-Hendrickson, Incorporated
3535 Vadnais Center Dr
Saint Paul, MN, 55110-5196
Project: BL-09-00745A
TH 7 & Louisiana Ave Design
TH 7 & Louisiana Avenue
St. Louis Park, MN, 55426
PM: Josh J VanAbel, jvanabel@BraunIntertec.com



Dallas Miner

Laboratory Supervisor

Date of Issue: 7/13/2011

Sample Details

Sample ID: W11-001210-S1
Alternate Sample ID: P-01
Sampled By: Scott Mclean
Sampling Method: Soil Boring Auger
Date Sampled: 5/20/2011
Date Submitted: 7/7/2011
Specification:
Source: Boring B-13, 1-3 ft
Material Type: Sandy Loam
Sample Location: Boring B-13

Test Results

Description	Method	Result	Limits
R Value	MnDOT 1307 - 95	71	
Date Tested		7/12/2011	
Certification #s		15600	
Date Tested		7/12/2011	

Comments

N/A



Minnesota Department of Transportation Geotechnical Section

Boring Log Descriptive Terminology (English Units)



USER NOTES, ABBREVIATIONS AND DEFINITIONS - Additional information available in Geotechnical Manual.

This boring was made by ordinary and conventional methods and with care deemed adequate for the Department's design purposes. Since this boring was not taken to gather information relating to the construction of the project, the data noted in the field and recorded may not necessarily be the same as that which a contractor would desire. While the Department believes that the information as to the conditions and materials reported is accurate, it does not warrant that the information is necessarily complete. This information has been edited or abridged and may not reveal all the information which might be useful or of interest to the contractor. Consequently, the Department will make available at its offices, the field logs relating to this boring.

Since subsurface conditions outside each borehole are unknown, and soil, rock and water conditions cannot be relied upon to be consistent or uniform, no warrant is made that conditions adjacent to this boring will necessarily be the same as or similar to those shown on this log. Furthermore, the Department will not be responsible for any interpretations, assumptions, projections or interpolations made by contractors, or other users of this log.

Water levels recorded on this log should be used with discretion since the use of drilling fluids in borings may seriously distort the true field conditions. Also, water levels in cohesive soils often take extended periods of time to reach equilibrium and thus reflect their true field level. Water levels can be expected to vary both seasonally and yearly. The absence of notations on this log regarding water does not necessarily mean that this boring was dry or that the contractor will not encounter subsurface water during the course of construction.

TW.....Thinwall (Shelby Tube)
WS.....Wash Sample
NSR.....No Sample Retrieved
WH.....Weight of Hammer
WR.....Weight of Rod
Mud.....Drilling Fluids in Sample
CS.....Continuous Sample

SOIL/CORE TESTS

SPT N₆₀.....ASTM D1586 Modified
Blows per foot with 140 lb. hammer and a standard energy of 210 ft-lbs. This energy represents 60% of the potential energy of the system and is the average energy provided by a Rope & Cathead system.
MC.....Moisture Content
COH.....Cohesion
?.....Sample Density
LL.....Liquid Limit
PI.....Plasticity Index
F.....Phi Angle
REC.....Percent Core Recovered
RQD.....Rock Quality Description
(Percent of total core interval consisting of unbroken pieces 4 inches or longer)
ACL.....Average Core Length
(Average length of core that is greater than 4 inches long)
Core Breaks.....Number of natural core breaks per 2-foot interval.

DISCONTINUITY SPACING

Fractures	Distance	Bedding
Very Close	<2 inches	Very Thin
Close	2-12 inches	Thin
Mod. Close	12-36 inches	Medium
Wide	>36 inches	Thick

WATER MEASUREMENT

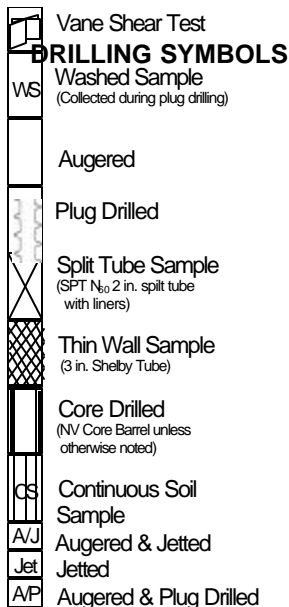
AB.....After Bailing
AC.....After Completion
AF.....After Flushing
w/C.....with Casing
w/M.....with Mud
WSD.....While Sampling/Drilling
w/AUG.....with Hollow Stem Auger

MISCELLANEOUS

NA.....Not Applicable
w/.....with
w/o.....with out
sat.....saturated

DRILLING OPERATIONS

AUG.....Augered
CD.....Core Drilled
DBD.....Disturbed by Drilling
DBJ.....Disturbed by Jetting
PD.....Plug Drilled
ST.....Split Tube (SPT test)



RELATIVE DENSITY

Compactness - Granular Soils	BPF
very loose	0-4
loose	5-10
medium dense	11-24
dense	25-50
very dense	>50

Consistency - Cohesive Soils

Consistency - Cohesive Soils	BPF
very soft	0-1
soft	2-4
firm	5-8
stiff	9-15
very stiff	16-30
hard	31-60
very hard	> 60

COLOR

blk	Black	wht	White
grn	Green	brn	Brown
orng	Orange	yel	Yellow
dk	Dark	lt	Light
IOS	Iron Oxide Stained		

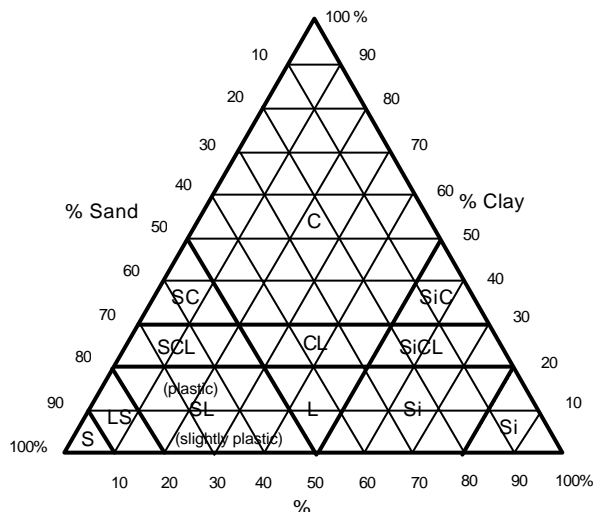
GRAIN SIZE /PLASTICITY

VF	Very Fine	pl	Plastic
F	Fine	slpl	Slightly Plastic
Cr	Coarse		

SOIL/ROCK TERMS

C	Clay	Lmst	Limestone
L	Loam	Sst	Sandstone
S	Sand	Dolo	Dolostone
Si	Silt	wx	weathered
G	Gravel (No. 10 Sieve to 3 inches)		
Bldr	Boulder (over 3 inches)		
T	till (unsorted, nonstratified glacial deposits)		

Mn/DOT Triangular Textural Soil Classification System



Appendix C

SEH Phase II Investigation (Submitted under Separate Cover)

Appendix D

Braun Soil Boring Report, 2009

Results of Soil Borings and Laboratory Testing

Soil Borings and Laboratory Testing
Preliminary Design - State Highway 7 and Louisiana Avenue
Intersection Reconstruction
St. Louis Park, Minnesota

Prepared for

Short Elliott Hendrickson, Inc.

Project BL-09-00745
July 16, 2009

Braun Intertec Corporation

BRAUN
INTERTEC

July 16, 2009

Project BL-09-00745

AJ Schwidder, PE
Short Elliott Hendrickson, Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110

Re: Soil Borings and Laboratory Testing
Preliminary Design - State Highway 7 and Louisiana Avenue
Intersection Reconstruction
St. Louis Park, Minnesota

Dear Mr. Schwidder:

We have completed the soil borings and laboratory testing requested by Short Elliott Hendrickson, Inc. (SEH) for the preliminary design of the Intersection State Highway 7 and Louisiana Avenue in St. Louis Park, Minnesota.

Scope of Services

Our work was completed in general accordance with our authorized Proposal for Soil Borings and Laboratory Testing, dated February 26, 2009.

For the project, our scope of services included performing a total of 12 standard penetration test soil borings to nominal depths of 20 to 30 feet below grade (one boring was extended to 35 feet due to poor soil conditions). Our services also included clearance of public utilities, traffic control, acquiring MnDOT right of way permits, laboratory testing as requested by SEH and preparation of a factual soil boring report.

Documents Provided

SEH provided us with a Preliminary Boring Plan for TH 7 – Louisiana Ave, which included the requested boring locations. The plan was prepared by SEH and was dated January 29, 2009.

Boring Locations and Elevations

We performed a total of 12 standard penetration test soil borings for the project. The soil borings were denoted as ST-1 to ST-12 and were performed at the approximate locations shown on the attached Soil Boring Location Sketch. SEH provided us with the surveyed boring coordinates, which were used to create a Soil Boring Location Sketch utilizing an aerial map from Google Earth®.

The boring locations were selected and staked by SEH. Ground surface elevations at the boring locations were also provided by SEH.

Drilling and Sampling

The penetration test borings were drilled with a truck-mounted core and auger drill equipped with hollow-stem auger. The borings were performed in accordance with ASTM D 1586. Penetration test samples were taken at 2 1/2 and 5-foot intervals. Actual sample intervals and corresponding depths are shown on the boring logs. Additional thinwall samples (TW) were taken in zones of organic soils.

Log of Boring Sheets

Log of Boring sheets for our penetration test borings are attached to this report. The logs identify and describe the geologic materials that were penetrated, present the results of penetration resistance tests, laboratory tests performed on penetration test samples retrieved from them, and groundwater measurements.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions.

Soil Classification

The geologic materials encountered were visually and manually classified in accordance with ASTM Test Method D 2488. A chart explaining the classification system is attached. Samples were sealed in jars or bags and returned to our facility for review by a geotechnical engineer and storage.

Laboratory Testing

We performed moisture content, dry density and Atterberg limits tests on jar and thinwall samples recovered from the soil borings in accordance with ASTM methods. The test results are shown or noted on the right side of the Log of Boring Sheets, across from the associated sample. The Atterberg limits test results are also shown on separate sheets attached to this report.

Groundwater Observations

The drillers checked for groundwater as the borings were advanced, and again after auger withdrawal. The boreholes were then backfilled with bentonite grout.

Groundwater Fluctuations

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation period was relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

Level of Care

In performing our services, Braun Intertec has used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of our profession currently practicing in the same locality. No warranty, express or implied, is made.

General

Please refer to the attached report for a detailed summary of our procedures and results. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding this report, please contact Josh Van Abel at 952.995.2310 or Matt Ruble at 952.995.2224.

Sincerely,

BRAUN INTERTEC CORPORATION



Joshua J. Van Abel, PE
Project Engineer



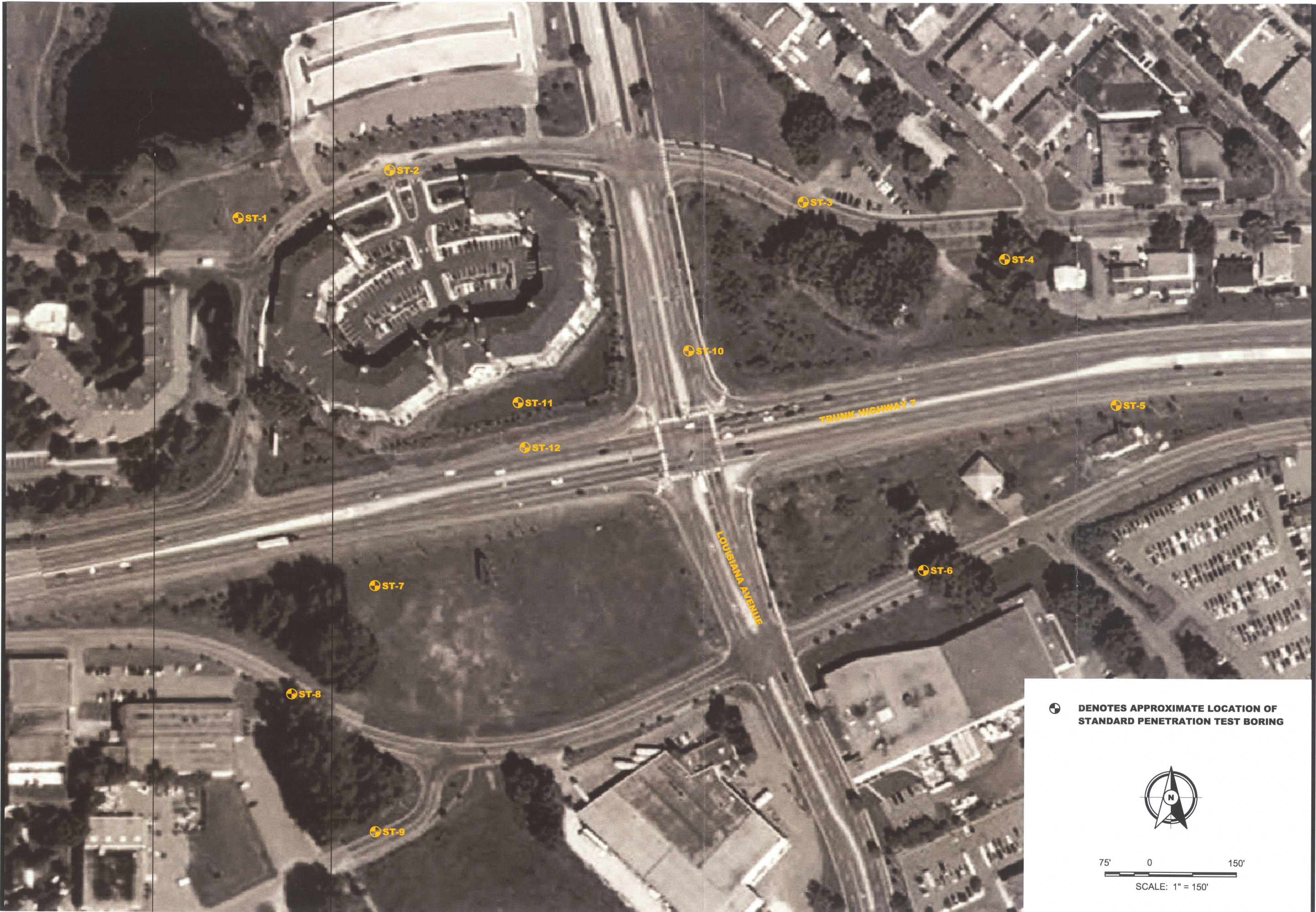
Matthew P. Ruble, PE
Principal Engineer

Attachments:

Soil Boring Location Sketch
Log of Boring Sheets ST-1 to ST-12
Atterberg Limits Results (1 Sheet)
Descriptive Terminology of Soil

Rpt Hwy 7 and Louisiana Avenue

F:\BL2009\BL0900745.dwg, BLAND, 5/27/2009 8:07:41 AM



⊕ DENOTES APPROXIMATE LOCATION OF
STANDARD PENETRATION TEST BORING



75' 0 150'
SCALE: 1" = 150'

BRAUN INTERTEC

11001 Hampshire Avenue So.
Minneapolis, MN 55438
PH. (952) 995-2000
FAX (952) 995-2020

Base Dwg Provided By:

©2008 Google

SOIL BORING LOCATION SKETCH
PRELIMINARY DESIGN
TRUNK HIGHWAY 7 AND LOUISIANA AVENUE
SAINT LOUIS PARK, MINNESOTA

Project No:
BL0900745

Drawing No:
BL0900745

Scale: 1" = 150'
Drawn By: BJB
Date Drawn: 5/27/09
Checked By: JJV
Last Modified: 5/18/09

Sheet:
of

Fig:

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-1 LOCATION: See attached sketch.		
DRILLER: M. Takada		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/26/09		SCALE: 1" = 4'	

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
889.1	0.0					
888.1	1.0	FILL	FILL: Clayey Sand, fine- to medium-grained, slightly organic, black, wet. (Topsoil/Fill)			Benchmark: Ground surface elevations provided by SEH, Inc.
		FILL	FILL: Clayey Sand, fine- to medium-grained, with bituminous fragments, black and brown, wet.	10		Note: Possible chemical odor detected in most soil samples below 5 to 7 feet at all boring locations.
885.1	4.0	FILL	FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with a trace of Gravel, dark brown, waterbearing.	10	▽	An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling. Groundwater levels fluctuate.
882.1	7.0	PT	PEAT, fibrous, black and dark brown, wet. (Swamp Deposit)	2		
			With Sand seams at 10 feet.	2		
875.1	14.0	OL	ORGANIC CLAY, with a trace of fibers, black, wet. (Swamp Deposit)	1		*Weight of hammer.
870.1	19.0	OL	ORGANIC SILT, with shells, light gray, wet. (Swamp Deposit)	3		*Water observed at 5 feet with 7 feet of hollow-stem auger in the ground.
865.1	24.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, gray, waterbearing, very loose. (Alluvium)	3		Water observed at 15 feet with 24 1/2 feet of hollow-stem auger in the ground.
863.1	26.0		END OF BORING.*			Water not observed to cave-in depth of 12 feet immediately after withdrawal of auger.
						Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/16/09 16:13

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-2 LOCATION: See attached sketch.		
DRILLER: C. Powers		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/27/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
891.1	0.0						
889.1	2.0	FILL	FILL: Silty Sand, fine- to medium-grained, with a trace of Gravel, non- to slightly organic, black and brown, moist.				
		FILL	FILL: Silty Sand, fine- to medium-grained, mixed with Organic Clay and Peat, with a trace of Gravel, black and dark brown, wet.	6			
884.1	7.0	PT	PEAT, with Sand seams, fibrous, black and dark brown, wet. (Swamp Deposit)	2			
881.1	10.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, gray, waterbearing, medium dense. (Alluvium)	TW*		*Thinwall sample.	
			With Peat lenses at 15 feet.	13			
				14			
870.1	21.0		END OF BORING.	13			
			Water observed at 9 feet with 9 1/2 feet of hollow-stem auger in the ground.				
			Water observed at 12 feet with 19 1/2 feet of hollow-stem auger in the ground.				
			Water not observed to cave-in depth of 7 feet immediately after withdrawal of auger.				
			Boring immediately backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-3 LOCATION: See attached sketch.		
DRILLER: C. Powers		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/27/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	qu tsf	Tests or Notes
892.1	0.0						
891.6	0.5	FILL	FILL: Silty Sand, fine- to medium-grained, non- to slightly organic, black, moist. (Topsoil/Fill)				
		FILL	FILL: Silty Sand, fine- to coarse-grained, with a little Gravel, brown, moist.	12			
888.1	4.0	CL	LEAN CLAY, slightly organic, with a trace of fibers, black, wet, rather soft. (Alluvium)	4			
885.1	7.0	CL	LEAN CLAY, with a trace of fibers, light gray, wet, rather soft to medium. (Alluvium)	4		1	
881.6	10.5	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, brown to gray, moist to waterbearing, loose. (Alluvium)	8	▽		
				7			
				9			
871.1	21.0			8			
			END OF BORING.				
			Water observed at 12 feet with 12 feet of hollow-stem auger in the ground.				
			Water observed at 16 feet with 19 1/2 feet of hollow-stem auger in the ground.				
			Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger.				
			Boring immediately backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-4 LOCATION: See attached sketch.		
DRILLER: C. Powers		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/27/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
895.7	0.0						
895.0	0.7	FILL	FILL: Clayey Sand, fine- to coarse-grained, with a trace of Gravel and bituminous fragments, dark brown, wet. <div style="text-align: center;">(Topsoil/Fill)</div> FILL: Clayey Sand, fine- to medium-grained, with Gravel and wood, with Silty Sand layers, brown and dark brown, moist to wet.	6			
888.7	7.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with a trace of Gravel, brown, moist, loose. <div style="text-align: center;">(Alluvium)</div>	8			
886.7	9.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, light brown to brown, moist to 11 1/2 feet then waterbearing, loose to very loose. <div style="text-align: center;">(Alluvium)</div>	9	▽		
				4			
				5			
874.7	21.0		END OF BORING. Water observed at 11 1/2 feet with 12 feet of hollow-stem auger in the ground. Water observed at 16 feet with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger. Boring immediately backfilled.	9			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota						BORING: ST-5 LOCATION: See attached sketch.	
DRILLER: C. Powers		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/27/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	qu tsf	Tests or Notes
896.8	0.0						
896.3	0.5	FILL	FILL: Silty Sand, fine- to medium-grained, non- to slightly organic, black, moist. (Topsoil/Fill)				
		FILL	FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with a trace of Gravel, with Silty Sand seams, brown and dark brown, moist.	28			
				21			
889.8	7.0	FILL	FILL: Clayey Sand, fine- to medium-grained, with Silty sand layers, with a trace of Gravel, dark brown and brown, moist to wet.	14			
887.8	9.0	FILL	FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with a trace of Gravel, brown, moist.	8			
884.8	12.0	OL	ORGANIC CLAY, with a trace of Gravel, black, wet. (Swamp Deposit)	5			
882.8	14.0	CL	LEAN CLAY with SAND, gray, wet, medium. (Alluvium)	7		1 1/2	
879.8	17.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, gray, moist, loose. (Alluvium)				
875.8	21.0		END OF BORING.	9			
			Water not observed with 19 1/2 feet of hollow-stem auger in the ground.				
			Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger.				
			Boring immediately backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-6 LOCATION: See attached sketch.		
DRILLER: C. Powers		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/27/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
892.2	0.0	PAV	8 inches of bituminous over 22 inches of aggregate base.				
889.7	2.5	FILL	FILL: Silty Sand, fine- to coarse-grained, with a trace of Gravel, dark brown, moist.	23			
888.2	4.0	FILL	FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with a trace of Gravel, with Clayey Sand seams, brown, moist.	13			
885.2	7.0	FILL	FILL: Silty Sand, fine- to medium-grained, with a trace of Gravel, dark brown, moist.	4*		*Little sample recovery.	
883.2	9.0	PT	PEAT, semi-fibrous, black to dark brown, wet. (Swamp Deposit)	3			
880.2	12.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, gray, waterbearing, loose. (Alluvium)	TW*		*Thinwall sample.	
				8			
871.2	21.0		END OF BORING.	6			
			Water observed at 14 feet with 14 1/2 feet of hollow-stem auger in the ground. Water observed at 17 feet with 19 1/2 feet of hollow-stem auger in the ground. Boring immediately backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota						BORING: ST-7 LOCATION: See attached sketch.			
DRILLER: M. Takada			METHOD: 3 1/4" HSA, Autohammer		DATE: 3/26/09		SCALE: 1" = 4'		
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	qu tsf	MC %	Tests or Notes	
893.4	0.0	FILL	FILL: Clayey Sand, fine- to medium-grained, non- to slightly organic, with a trace of Gravel, dark brown, wet. (Topsoil/Fill) FILL: Silt (possible fly ash), white, wet.						
892.8	0.6	FILL							
887.4	6.0	SM	SILTY SAND, fine- to medium-grained, with a trace of fibers, slightly organic, black, waterbearing. (Alluvium)	2					
884.4	9.0	PT	PEAT, fibrous, dark brown, wet. (Swamp Deposit)	6					
878.4	15.0	CL	LEAN CLAY with SAND, gray, wet, soft. (Alluvium)	2					
874.4	19.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with a trace of Gravel, gray, waterbearing, loose. (Alluvium)	7	▽				
872.4	21.0		END OF BORING. Water observed at 19 feet with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 14 feet immediately after withdrawal of auger. Boring immediately backfilled with bentonite grout.						
							238	*Thinwall sample. DD=20 pcf	

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-8 LOCATION: See attached sketch.		
DRILLER: J. Chermak		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/25/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
893.9	0.0						
892.4	1.5	PAV	6 inches of bituminous over 12 inches of aggregate base.				
		FILL	FILL: Silty Sand, fine- to coarse-grained, with Gravel, concrete fragments and bituminous fragments, dark brown, moist.	14			
				8			
886.9	7.0	FILL	FILL: Peat, black, wet.	6			
884.9	9.0	FILL	FILL: Lean Clay, non- to slightly organic, with Silty Sand seams, black and gray, wet.	8			
882.9	11.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with Gravel, gray to brown, waterbearing, medium dense. (Alluvium)	20	▽		
				27*		*Encountered Gravel. No sample recovery.	
				20			
872.9	21.0		END OF BORING.				
			Water observed at 12 feet with 12 feet of hollow-stem auger in the ground.				
			Water observed at 17 feet with 19 1/2 feet of hollow-stem auger in the ground.				
			Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger.				
			Boring immediately backfilled with bentonite grout.				

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-9 LOCATION: See attached sketch.		
DRILLER: J. Chermak		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/25/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
890.7	0.0	PAV	6 inches of bituminous over 10 inches of aggregate base.				
889.3	1.4	FILL	FILL: Silty Sand, fine- to coarse-grained, with Gravel, dark brown, moist.	28			
886.7	4.0	FILL	FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with a trace of Gravel, brown, moist.	16			
883.2	7.5	PT	PEAT, semi-fibrous, dark brown, wet. (Swamp Deposit)	5			
878.7	12.0	OL	ORGANIC SILT, with shells, light gray, wet. (Swamp Deposit)	4			
874.7	16.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, gray, waterbearing, medium dense to very loose. (Alluvium)	21*			
869.7	21.0		END OF BORING.	4			
			Water observed at 17 feet with 17 feet of hollow-stem auger in the ground.				
			Water observed at 15 feet with 19 1/2 feet of hollow-stem auger in the ground.				
			Water observed at 6 feet with a cave-in depth of 6 1/2 feet immediately after withdrawal of auger.				
			Boring immediately backfilled with bentonite grout.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-10	
DRILLER: D. Bailey					LOCATION: See attached sketch.	
METHOD: 3 1/4" HSA, Autohammer			DATE: 3/26/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
896.2	0.0					
895.4	0.8	PAV	9 inches of bituminous.			
894.2	2.0	FILL	FILL: Silty Sand, fine- to coarse-grained, with Gravel, dark brown, moist.			
892.2	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, with concrete fragments and Clayey Sand layers, dark brown and black, moist.	8		
		FILL	FILL: Poorly Graded Sand, fine- to coarse-grained, with a trace of Gravel, brown, moist.	12		
889.2	7.0	FILL	FILL: Silty Sand, fine- to medium-grained, with Organic Clay layers, with a trace of Gravel, brown and black, moist to wet.	11		
887.2	9.0	FILL	FILL: Organic Clay, with a trace of Gravel and fibers, with Sand layers, black and dark brown, wet.	8		
884.2	12.0	PT	PEAT, fibrous, dark brown, wet. (Swamp Deposit)	7		
				8		
877.2	19.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, gray, waterbearing, loose to very loose. (Alluvium)	8		
				4*		
866.2	30.0	SC	CLAYEY SAND, fine- to medium-grained, with a trace of Gravel, gray, wet, very stiff.** (Glacial Till)	17		
865.2	31.0					

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

*Thinwall sample.

**END OF BORING AT 31 FEET.

Water observed at 19 feet with 19 1/2 feet of hollow-stem auger in the ground.

Water observed at 18 feet with 29 1/2 feet of hollow-stem auger in the ground.***

*No sample recovery.

***Boring immediately backfilled with bentonite grout.

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota						BORING: ST-11 LOCATION: See attached sketch.		
DRILLER: M. Takada		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/26/09		SCALE: 1" = 4'		
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes	
891.7	0.0	FILL	FILL: Clayey Sand, fine- to medium-grained, slightly organic, with a trace of Gravel, with Silty Sand seams, black and dark brown, wet. (Topsoil/Fill)	14				
887.7	4.0	FILL	FILL: Clayey Sand, fine- to medium-grained, with a trace of Gravel, dark brown and gray, wet.	7				
884.7	7.0	PT	PEAT, fibrous to semi-fibrous, dark brown to black, wet. (Swamp Deposit)	7				
				TW*	▽	436	*Thinwall sample. DD=11 pcf	
				1				
				3				
872.7	19.0	OL	ORGANIC SILT, with shells, light gray, wet. (Swamp Deposit)	4				
			With Sand seams at 25 feet.	4				
864.7	27.0	SP	POORLY GRADED SAND, fine- to coarse-grained, with a trace of Gravel, green, waterbearing, loose. (Alluvium)					
860.7	31.0			7				
END OF BORING.*								

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-12 LOCATION: See attached sketch.		
DRILLER: J. Chermak		METHOD: 3 1/4" HSA, Autohammer		DATE: 3/26/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes
895.9	0.0	PAV	6 1/2 inches of bituminous over 12 inches of aggregate base.				
894.4	1.5	FILL	FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with a trace of Gravel, brown, moist.	28			
888.9	7.0	FILL	FILL: Poorly Graded Sand, fine- to coarse-grained, with a trace of Gravel, light brown and brown, moist.	15			
881.9	14.0	FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with a trace of Gravel, dark brown, waterbearing.	9			
876.9	19.0	SM	SILTY SAND, fine- to medium-grained, dark brown, waterbearing. (Possible Fill)	8			
874.9	21.0	PT	PEAT, black, wet. (Swamp Deposit)	5			
872.4	23.5	OL	ORGANIC SILT, with shells, light gray, wet. (Swamp Deposit)	TW*		117	*Thinwall sample. LL=128, PI=60 DD=39 pcf
866.9	29.0	CL	LEAN CLAY, non- to slightly organic, gray, wet, medium. (Alluvium)	7			
864.9	31.0	SP					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42

Braun Project BL-09-00745 SOIL BORINGS AND LABORATORY TESTING Preliminary Design-State Highway 7 & Louisiana Avenue Intersection Reconstruction St. Louis Park, Minnesota					BORING: ST-12 (cont.)						
DRILLER: J. Chermak					METHOD: 3 1/4" HSA, Autohammer			DATE: 3/26/09		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	Tests or Notes				
863.9	32.0		POORLY GRADED SAND, fine- to coarse-grained, with Gravel, gray, waterbearing, medium dense. (Alluvium) <i>(continued)</i>	20							
859.9	36.0		END OF BORING. Water observed at 12 1/2 feet with 12 1/2 feet of hollow-stem auger in the ground. Water observed at 28 feet with 34 1/2 feet of hollow-stem auger in the ground. Boring immediately backfilled with bentonite grout.								

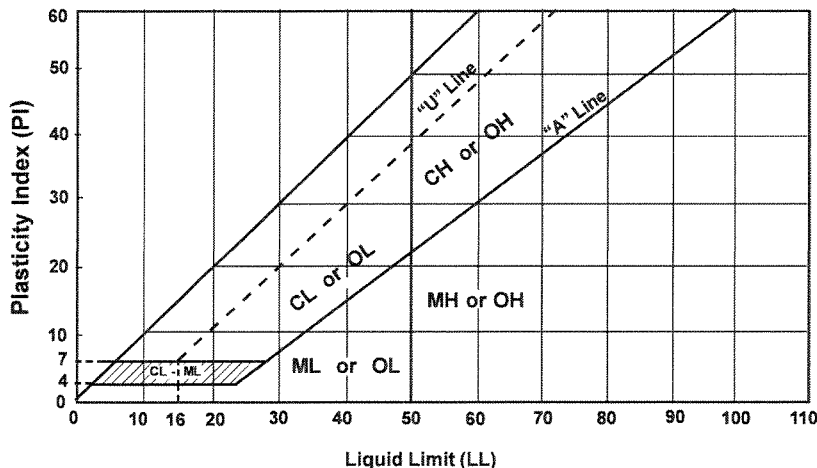
(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 00745.GPJ BRAUN_08.GDT 7/15/09 11:42



Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^a					Soils Classification	
					Group Symbol	Group Name ^b
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines ^a	$C_u \geq 4$ and $1 \leq C_c \leq 3$ ^c	GW	Well-graded gravel ^d	
			$C_u < 4$ and/or $1 > C_c > 3$ ^c	GP	Poorly graded gravel ^d	
		Gravels with Fines More than 12% fines ^a	Fines classify as ML or MH	GM	Silty gravel ^{d f g}	
			Fines classify as CL or CH	GC	Clayey gravel ^{d f g}	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines ⁱ	$C_u \geq 6$ and $1 \leq C_c \leq 3$ ^c	SW	Well-graded sand ^h	
			$C_u < 6$ and/or $1 > C_c > 3$ ^c	SP	Poorly graded sand ^h	
		Sands with Fines More than 12% ⁱ	Fines classify as ML or MH	SM	Silty sand ^{f g h}	
			Fines classify as CL or CH	SC	Clayey sand ^{f g h}	
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line ^j	CL	Lean clay ^{k l m}	
			PI < 4 or plots below "A" line ^j	ML	Silt ^{k l m}	
		Organic	Liquid limit - oven dried < 0.75	OL	Organic clay ^{k l m n}	
			Liquid limit - not dried	OL	Organic silt ^{k l m o}	
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay ^{k l m}	
			PI plots below "A" line	MH	Elastic silt ^{k l m}	
		Organic	Liquid limit - oven dried < 0.75	OH	Organic clay ^{k l m p}	
			Liquid limit - not dried	OH	Organic silt ^{k l m q}	
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat	

- a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$, $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
d. If soil contains $\geq 15\%$ sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Liquid Limit (LL)

Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	ϕ	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.

Appendix E

Braun Soil Borings, 2004

Braun Project BL-04-02033
GEOTECHNICAL EVALUATION
Louisiana Avenue Improvements
Lake Street to Walker Street
St. Louis Park, Minnesota

BORING: ST-1
LOCATION: See attached sketch.

DRILLER: Dave Lovassen **METHOD: 3 1/4" HSA Autohammer** **DATE: 1/16/04** **SCALE: 1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 0402033.GPJ BRAUN.GDT 25/04 14:12

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
96.9	0.0					
94.9	2.0	FILL	FILL: Clayey Sand, fine- to medium-grained, with Gravel and Roots, dark brown, wet.			Benchmark: The hydrant located on the southeast corner of Highway 7 and Lake Street, elevation equals 100.0.
		FILL	FILL: Clayey Sand, fine- to medium-grained, with a trace of Gravel, brown to dark brown, wet.	14		
91.9	5.0	FILL	FILL: Silty Sand, with fibrous Peat, with a trace of Gravel and Limestone fragments, brown with black, moist to wet.	12		
88.9	8.0	PT	PEAT, fibrous, dark brown to black, wet. (Swamp Deposit)	4		Foreign odor detected in all samples from 10 to 20 feet.
				3		
				2		
82.9	14.0	OL	ORGANIC CLAY, with shells, black, wet.	3		
78.9	18.0	SM	SILTY SAND, fine- to coarse-grained, with Gravel, dark brown, waterbearing, medium dense. (Alluvium)	14	▽	Tar/oil observed in the 20-foot sample.
76.4	20.5		END OF BORING.			
			Water observed at 18 feet while drilling. Boring immediately backfilled with grout.			An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling. A solid triangle indicates the stable groundwater level in the boring on the date indicated. Groundwater levels fluctuate.

Braun Project BL-04-02033
GEOTECHNICAL EVALUATION
Louisiana Avenue Improvements
Lake Street to Walker Street
St. Louis Park, Minnesota

BORING: ST-2
LOCATION: See attached sketch.

DRILLER: Dave Lovassen **METHOD: 3 1/4" HSA Autohammer** **DATE: 1/16/04** **SCALE: 1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
101.6	0.0					
		FILL	FILL: Clayey Sand, fine- to medium-grained, with Gravel and Concrete, dark brown, wet.			
99.6	2.0					
		FILL	FILL: Silty Sand, fine- to medium-grained, with fibrous Peat and Organic Clay, with a trace of Gravel and Concrete, brown with black, moist to wet.	4		
				7		
94.6	7.0					
		FILL	FILL: Clayey Sand, fine- to medium-grained, with Silty Sand layers, with a trace of Gravel, Limestone fragments and Bituminous, dark brown, wet.	16		
				19		
91.1	10.5					
			END OF BORING.			
			Water not observed while drilling.			
			Water not observed to cave-in depth of 6 feet immediately after withdrawing the auger.			
			Boring immediately backfilled.			

BRAUN BASIC LOG 0402033.GPJ BRAUN.GDT 2/3/04 14:12

Braun Project BL-04-02033 GEOTECHNICAL EVALUATION Louisiana Avenue Improvements Lake Street to Walker Street St. Louis Park, Minnesota					BORING: ST-3 LOCATION: See attached sketch.				
DRILLER: Dave Lovassen			METHOD: 3 1/4" HSA Autohammer		DATE: 1/16/04		SCALE: 1" = 4'		
Elev. feet 99.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	OC %	Tests or Notes	
		FILL	FILL: Clayey Sand, fine- to medium-grained, non to slightly organic, with a trace of Gravel, dark brown, wet.	5		16	4		
93.6	5.5		END OF BORING.	9					
Water not observed while drilling. Boring immediately backfilled.									

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 0402033.GPJ BRAUN.GDT 2/3/04 14:12

Braun Project BL-04-02033 GEOTECHNICAL EVALUATION Louisiana Avenue Improvements Lake Street to Walker Street St. Louis Park, Minnesota				BORING: ST-4 LOCATION: See attached sketch.		
DRILLER: Dave Lovassen		METHOD: 3 1/4" HSA Autohammer		DATE: 1/16/04	SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
99.1	0.0					
97.6	1.5	FILL	FILL: Clayey Sand, fine- to medium-grained, with a trace of Gravel and Roots, dark brown and black, wet.			
		FILL	FILL: Silty Sand, fine- to medium-grained, with a trace of Gravel and Concrete, brown with dark brown, moist.	10		
				14		
				8		
			With Peat layers from 8 to 11 feet.	7	▽	
88.1	11.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with a trace of Gravel, gray, waterbearing, loose to medium dense. (Alluvium)	11		
				8		
78.6	20.5			13		
			END OF BORING.			
			Water observed at 10 feet while drilling.			
			Boring immediately backfilled with grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 0402033.GPJ BRAUN.GDT 2/3/04 14:12


Braun Project BL-04-02033 GEOTECHNICAL EVALUATION Louisiana Avenue Improvements Lake Street to Walker Street St. Louis Park, Minnesota					BORING: ST-5 LOCATION: See attached sketch.		
DRILLER: Dave Lovassen		METHOD: 3 1/4" HSA Autohammer		DATE: 1/16/04		SCALE: 1" = 4'	
Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes	
98.0	0.0	FILL	FILL: Sandy Lean Clay, with Gravel and Roots, dark brown, wet.				
96.0	2.0	FILL	FILL: Sandy Lean Clay, with a trace of Gravel and Limestone fragments, with fibrous Peat layers, dark brown, gray and black, wet.	16			
92.0	6.0	CL	LEAN CLAY, with a trace of Fibers, gray, wet, rather soft to medium. (Alluvium)	4	▽		
86.0	12.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with a trace of Gravel, gray, waterbearing, very loose to loose. (Alluvium)	5	▼		
77.5	20.5		END OF BORING. Water observed at 8 feet while drilling. Water observed at 12 feet immediately after withdrawing the auger. Boring immediately backfilled with grout.	8			

(See Descriptive Terminology sheet for explanation of abbreviations)

 BRAUN BASIC LOG 0402033.GPJ BRAUN.GDT 2/2/04 14:12

Appendix F


STS Soil Borings, 1989

 STS Consultants Ltd.		OWNER		LOG OF BORING NUMBER	
		City of St. Louis Park		B-1	
SITE LOCATION St. Louis Park, Minnesota		PROJECT NAME		ARCHITECT-ENGINEER	
		T.H. 7 Surcharge at Old Louisiana Avenue		BRW Inc.	

DEPTH IN FEET	SAMPLE NO	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DR. WT. LBS. FT.	UNCONFINED COMPRESSIVE STRENGTH TONS FT ²					PLASTIC LIMIT %			WATER CONTENT %			LIQUID LIMIT %		
							1	2	3	4	5	1	2	3	4	5	1	2	3	4
					SURFACE ELEVATION Approx. + 180.5 ft															
					Driller's Note: 3.5 inches asphalt over silty sand fill.															
-5	1	ST																		
	1A	ST				19.3													273%	
-10	2	ST			Fine fibrous to amorphous peat - black - medium - (Pt)	26.8													183%	
-15	3	ST				98.0														
-20	4	ST			Silt, trace fine sand, few fine roots - gray - saturated - loose (est.) - (ML)	99.1														
22.0					End of boring at 22.0 ft. Hollow stem auger to full depth.															
-25																				
-30																				

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

WL	--	WS OR WD	BORING STARTED	4/6/89	STS OFFICE	Minnesota	
WL	--	BCR -- ACR	BORING COMPLETED	4/6/89	DRAWN BY	AN	SHEET NO. 1 OF 1
WL	16.8 ft. 0.5 hr. AB	RIG	D-50	FOREMAN	GD	APP'D BY	MBS STS JOB NO. 94019-H

 STS Consultants Ltd.		OWNER		LOG OF BORING NUMBER	
		City of St. Louis Park		B-2	
SITE LOCATION St. Louis Park, Minnesota		PROJECT NAME		ARCHITECT-ENGINEER	
		T.H. 7 Surcharge at Old Louisiana Avenue		BRW, Inc.	
DEPTH (FT) ELEVATION (FT)	SAMPLE NO. SAMPLE TYPE SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION Approx. + 180.5 ft.		UNCONFIRMED COMPRESSIVE STRENGTH TONS/FT ²	
				PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % X ● Δ	
				STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50	
		Driller's Note: 3 inches asphalt over silty sandy fill.			
5.0	1 SS	Peat and fine to coarse sand - black - saturated - (Pt) - (possible fill)		17	
10.0	2 ST	Fine fibrous to amorphous peat, few shells - black - medium - (Pt)		26.3	192%
15.0	3 ST	Clayey silt, trace fine sand, few fine roots - gray - saturated - loose (est.) - (ML-CL)		95.5	
20.0	4 SS	Fine to coarse sand and gravel, trace silt - gray - saturated - medium dense - (SW-SM) Note: Clayey silt seam at 20.5 ft.		18	
25.0	5 SS			24	
30.0	6 SS			29	
35.0	7 SS			18	
		(continued on next page)			

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

STS JOB NO. 94019-H


SHEET NO. 1 OF 2


SL-4-0587

		OWNER City of St. Louis Park		LOG OF BORING NUMBER B-2	
		PROJECT NAME T.R. 7 Surcharge at Old Louisiana Avenue		ARCHITECT-ENGINEER BRW, Inc.	
SITE LOCATION St. Louis Park, Minnesota					

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT PEN. (BLows/FT)	UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)	PLASTIC LIMIT %	WATER CONTENT %	LIQUID LIMIT %
						SURFACE ELEVATION Approx. + 180.5 ft.					
(continued from previous page)											
40.0		8	SS			Fine to medium sand, trace silt - brown - saturated - medium dense to dense - (SP)					
45.0		9	SS								
50.0		10	SS								
55.0		11	SS			Fine to coarse sand, some silt, trace to little gravel - brown - saturated - dense - (SM)					
60.0		12	SS								
65.0		13	SS								
		13A	SS			Limestone fragments - gray - extremely dense - (apparent bedrock)					
69.5		14	SS								
End of boring at 69.5 ft. Hollow stem auger to 20 ft. Roller bit with drilling mud 20 ft. to end of boring.											

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES; IN-SITU, THE TRANSITION MAY BE GRADUAL.					
WL	5.3 ft. WD	WS OR WD	BORING STARTED	4/7/89	STS OFFICE Minnesota
WL	---	BCR	BORING COMPLETED	4/7/89	DRAWN BY AM
					SHEET NO. 2 OF 2
WL	Obscured by mud AB		RIG FOREMAN	D-50 CD	APP'D BY MBS
					STS JOB NO. 94019-R

 STS Consultants Ltd.		OWNER City of St. Louis Park		LOG OF BORING NUMBER B-4	
		PROJECT NAME Louisiana Ave. Reconstruction		ARCHITECT-ENGINEER BRW, Inc.	
SITE LOCATION Louisiana Ave./Lake St.; St. Louis Park, MN.					
DEPTH IN FEET	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	UNCONFINED COMPRESSIVE STRENGTH TONS $\frac{1}{2}$ " 1 2 3 4 5 PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % X-----●-----△ 10 20 30 40 50 STANDARD PENETRATION BLOWS/FT 10 20 30 40 50
				SURFACE ELEVATION 183.64 ft.	
	1	AS		4 inches of asphalt; 8 inches of base gravel	
	2	AS		Silty sand, little gravel - brown - moist to desiccate - (SM)	
-5	3	SS		Sandy, organic fill, peat, trace gravel - black - dense to very dense - (Pt/SM) frozen material	12/6"
	4	SS		gravel reflected in high blow count creosote smell	2H
	5	SS		Medium to coarse sand, trace silt - black to brown - medium dense - moist - (SP) rubble in fill; creosote smell	8
-10	6	ST		Organic peat, trace sand - black - soft - moist - (Pt) Creosote smell	15.0 346.4%
	7	ST			17.7 311.2%
	8	ST			33.0 191.0%
-15	8A	ST		Organic peat, layered with organic clays, silty clays & silty sand - black - moist - (Pt) creosote smell	
	9	ST			
-20	9A	ST		Clay, trace sand - gray - moist - (CL) - slight creosote odor	
	10	SS			
	11	SS		Medium to coarse sand, trace silt and gravel - medium dense to dense - wet to saturated - (SM)	25/4"
-25	12	SS		3 inches seam of peat at 23.5 ft. slight creosote odor	9
				End of boring at 25.5 ft. Hollow stem augered to full depth. Boring backfilled and patched.	* Calibrated penetrometer
-30					
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.					
WL		WS OR WD	BORING STARTED 2-27-89		STS OFFICE Minnesota
WL 14.3 ft. BCR		ACR	BORING COMPLETED 2-27-89		DRAWN BY AN SHEET NO. 1 OF 1
WL		RIG CME-75	FOREMAN DZ	APP'D BY SMG	STS JOB NO. 94019-F

 STS Consultants Ltd.		OWNER City of St. Louis Park		LOG OF BORING NUMBER B-5									
		PROJECT NAME Louisiana Ave. Reconstruction		ARCHITECT-ENGINEER BRW, Inc.									
SITE LOCATION Louisiana Ave./Lake St.; St. Louis Park, MN.													
DEPTH IN FEET	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT ³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT ²		PLASTIC LIMIT %		WATER CONTENT %		LIQUID LIMIT %	
						1	2	3	4	5	1	2	3
SURFACE ELEVATION				181.18 ft.									
	1	AS		2.75 inches of asphalt; 8 inches of gravel base; 6.5 ft of frost									
	2	AS		Silty fine to medium sand, trace gravel - brown - moist to desiccated - (SM)									
	3	SS		slight organic odor									
-5-	3A	SS											
	4	SS		Organic peat, trace gravel & sand - black									
	5	ST		visable creosote in all samples; no recovery in sample 5 due to rock									
-10-	6	ST			24.4							188.3%	
	7	ST			22.4							199.8%	
-15-	8	SS		Fine to coarse sand, little gravel - gray - medium dense - (SP)									
	9	SS		creosote visible in samples									
	10	SS											
-20-				End of boring at 20.0 ft. Hollow stem augered to full depth. Boring backfilled and patched.									
-25-													
-30-													
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.													
WL	9.5 ft. WD WS OR WD		BORING STARTED 2-27-89		STS OFFICE Minnesota								
WL	BCR	ACR	BORING COMPLETED 2-27-89		DRAWN BY AN SHEET NO. 1 OF 1								
WL	RIG CME-75 FOREMAN DZ		APP'D BY SMG		STS JOB NO. 94019-F								

111
A

Appendix G

Braun Soil Borings, 1980

LOG OF BORING



PROJECT: 80-135 SOIL BORINGS Louisiana Ave. Extension Between Walker & W. Lake St. St. Louis Park, Minnesota				BORING: ST-64 LOCATION: Station 110+50, 10' west of centerline.		
DATE: 5/2/80				SCALE: 1"=4'		
Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM: D2488)	BPF	WL	Tests or Notes
179.5	0					
177.5	2	SP-SM with Pt	Fill; SAND, SLIGHTLY SILTY, fine to medium-grained, mixed with some PEAT, black, moist to wet.	3		
		SP	Fill; SAND, fine to medium- grained, with a little fine Gravel, brown, wet.	7		
175.0	4.5	Pt	PEAT, amorphous, with a trace of shells, wood and occasional lenses of MUCK, dark brown to black, wet. (Swamp Deposit)	3/1		MC = 333.4% OC = 73.6%
				2		MC = 147.6% OC = 25.0%
169.5	10	SC-SM with SP	SILTY CLAYEY SAND, fine to medium-grained, with layers of fine-grained SILTY SAND and fine to coarse-grained SAND,*	2		MC = 180.2% OC = 32.0%
166.5	13	SP	SAND, fine to medium-grained, gray, waterbearing. (Glacial Outwash)	11		*gray, wet, medium dense. (Glacial Outwash)
165.0	14.5	ML with SP	CLAYEY SILT, slightly plastic, with a few layers of fine to coarse SAND, gray, wet,**	11		**medium dense. (Glacial Outwash)
162.5	17	SP	SAND, fine to coarse-grained, gray, waterbearing, loose. slight chemical odor (Glacial Outwash)			
159+	20.5		Water level down 14' with 19' of hollow-stem auger in ground. Water level down 2' 1/4 hour after completion of boring. Water level down 2' 3-1/2 hours after completion of boring.	10		

50010496

(See Report and Standard Plates for evaluation and descriptive terminology.)

LOG OF BORING



PROJECT: 80-135 SOIL BORINGS Louisiana Ave. Extension Between Walker & W. Lake St. St. Louis Park, Minnesota				BORING: ST-65 LOCATION: Station 111+55 on centerline.	
				DATE: 5/2/80	SCALE: 1"=4'
Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM: D2488)	BPF	WL Tests or Notes
179.5±	0				
178.0	1.5	SM	Fill; SILTY SAND, fine to medium-grained, with a trace of fine*	11	*Gravel, black, moist.
		SP	Fill; SAND, fine to coarse-grained, with a trace of fine Gravel, brown, wet.	20	
				19	
173.0	6.5	Pt	PEAT, amorphous, dark brown to brown, wet. (Swamp Deposit)	2	MC = 287.4% OC = 50.5%
170.0	9.5	Pt	MUCK, with a trace of shells and wood, dark olive, moist. (Swamp Deposit)	2	MC = 186.9% OC = 33.3%
166.5	13		with a thin layer of bog lime.	3	MC = 85.9% DD = 47.8 pcf
		ML	CLAYEY SILT, non to slightly plastic, with a trace of fibers, gray, wet, loose. (Alluvium)	6	MC = 30.3%
163.5	16	SP	SAND, fine to coarse-grained, with some fine to medium Gravel, gray, waterbearing, medium dense. slight chemical odor. (Glacial Outwash)		
159±	20.5			13	
			Water level down 13' with 19' of hollow-stem auger in ground. Water level down 3' 1/4 hour after completion of boring. Water level down 2' 2-3/4 hours after completion of boring.		

50011497

(See Report and Standard Plates for evaluation and descriptive terminology.)

Appendix H

Groundwater Elevation Table

Water Level Data

2011, Geotech				2011, Phase II				2009, Geotech			
Boring	Elevation	Water Depth (ft)	Water Elev	Boring	Elevation	Water Depth (ft)	Water Elev	Boring	Elevation	Water Depth (ft)	Water Elev
R-1	893.9	9	884.9	GP-01	894	7.2	886.8	B-1	889.1	5	884.1
R-2	892.9	7	885.9	GP-02	894	13	881.0	B-2	891.1	9	882.1
R-3	892.0	4	888.0	GP-03	893	11	882.0	B-3	892.1	12	880.1
R-4	895.3	7.5	887.8	GP-04	892	7.5	884.5	B-4	895.7	11.5	884.2
R-5	897.0	12	885.0	GP-05	893	4	889.0	B-5	896.8	-	-
R-6	897.0	4	893.0	GP-06	891	8	883.0	B-6	892.2	14	878.2
R-7	896.6	12	884.6	GP-07	894	8.5	885.5	B-7	893.4	19	874.4
R-8	888.0	4	884.0	GP-08	896	9.5	886.5	B-8	893.9	12	881.9
R-9	897.7	19	878.7	GP-09	895	9.7	885.3	B-9	890.7	6	884.7
E-1	896.5	17	879.5	GP-10	892	6.4	885.6	B-10	896.2	18	878.2
E-2	896.6	13	883.6	GP-11	892	6.4	885.6	B-11	891.7	11	880.7
E-3	896.6	12	884.6	GP-12	894	15	879.0	B-12	895.9	12.5	883.4
E-4	893.1	7	886.1	GP-13	895	-	-	Avg	St. Dev.	Max	Min
E-5	898.9	8	890.9	GP-14	895	8	887.0	881.1	3.2	884.7	874.4
C-1	895.3	7	888.3	GP-15	897	9	888.0				
C-2	895.4	8.5	886.9	GP-16	888	15.5	872.5				
C-3	895.7	10	885.7	GP-17	888	8	880.0				
C-4	897.1	12	885.1	GP-18	888	3	885.0				
C-5	897.2	12	885.2	GP-19	897	6	891.0				
C-6	897.6	15	882.6	GP-20	896	6	890.0				
C-7	897.6	15	882.6	GP-21	896	7.5	888.5				
C-8	898.3	15	883.3	GP-22	894	7.5	886.5				
C-9/9A	897.7	15	882.7	GP-23	896	11	885.0				
C-10	897.6	16	881.6	GP-24	898	12	886.0				
C-11	898.3	14	884.3	GP-25	897	7.6	889.4				
C-12	901.2	17	884.2	GP-26	905	23	882.0				
P-1	888.0	7	881.0	GP-27	907	-	-				
B-1	915.0	-	-	GP-28	906	21.9	884.1				
B-2	905.9	19	886.9	GP-29	893	19	874.0				
B-3	900.2	14	886.2	GP-30	890	12	878.0				
B-4	896.6	12	884.6	GP-31	894	-	-				
B-5	897.5	14	883.5	GP-32	893	7.6	885.4				
B-6	890.7	4	886.7	GP-33	893	7.5	885.5				
B-7	892.8	10.5	882.3	Avg	St. Dev.	Max	Min				
B-8	901.1	17	884.1	884.4	4.3	891.0	872.5				
B-9	904.8	-	-								
B-10	904.1	18	886.1								
B-11	911.7	-	-								
B-12	907.2	-	-								
B-13	906.8	-	-								
B-14	907.9	-	-								
Avg	St. Dev.	Max	Min								
884.9	2.8	893.0	878.7								

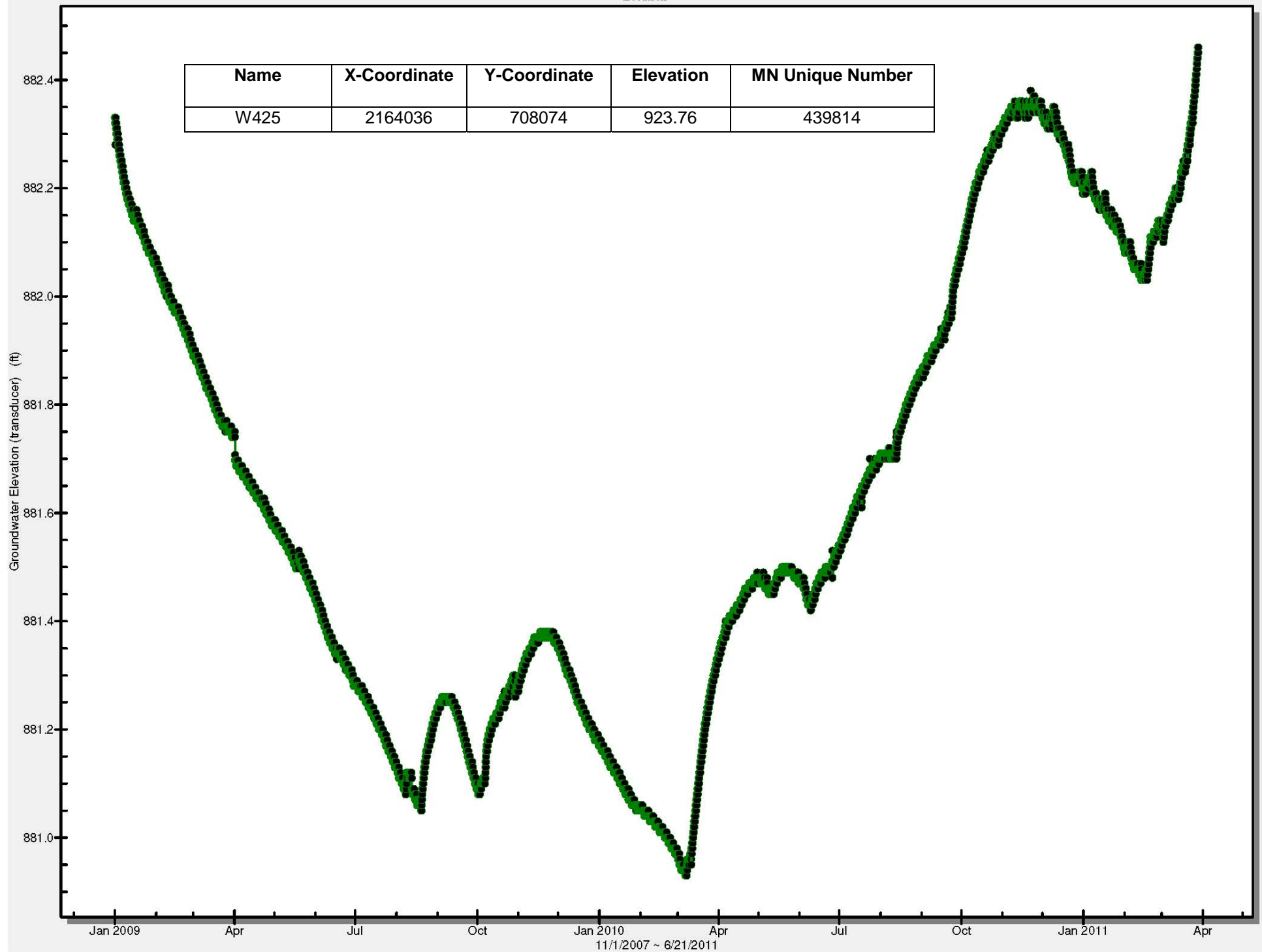
Appendix I

Water Level Data from Summit Observation Well, W425

Parameter trending

Location

Name	X-Coordinate	Y-Coordinate	Elevation	MN Unique Number
W425	2164036	708074	923.76	439814



Appendix J

Literature Paper by Jim Collin

Geosynthetic-Reinforced Column-Support Embankment Design Guidelines

James G. Collin¹, J. Han², and J. Huang³

¹President, The Collin Group, Ltd., 7445 Arlington Road, Bethesda, MD 20814, PH (301) 907-9501; FAX (301) 907-9502; e-mail: jim@thecollingroup.com

²Associate Professor, Civil, Environmental, & Architectural Engineering (CEAE) Department, the University of Kansas, 2150 Learned Hall, 1530 W. 15th Street, Lawrence, Kansas 66045-7609; PH (785) 864-3766; FAX (785) 864-5631; email: jiehan@ku.edu.

³Graduate Research Assistant, Civil, Environmental, & Architectural Engineering (CEAE) Department, the University of Kansas, 2150 Learned Hall, 1530 W. 15th Street, Lawrence, Kansas 66045-7609; email: jhuang@ku.edu.

Keywords: Load transfer platform, geosynthetic reinforcement, ground improvement.

Abstract

The problems associated with constructing highway embankments over soft compressible soil (i.e., large settlements, embankment instability and the long period of time required for consolidation of the foundation soil) has lead to the development and/or extensive use of many of the ground improvement techniques used today. Wick drains, surcharge loading, and geosynthetic reinforcement, have all been used to solve the settlement and embankment stability issues associated with construction on marginal soils. However, when time constraints are critical to the success of the project, owners have resorted to another innovative approach: geosynthetic reinforcement column supported embankments.

Column supported embankments (CSE) consist of vertical columns that are designed to transfer the load of the embankment through the soft compressible soil layer to a firm foundation. The load from the embankment must be effectively transferred to the columns to prevent punching of the columns through the embankment fill creating differential settlement at the surface of the embankment. If the columns are placed close enough together, soil arching will occur and the load will be transferred to the columns. In order to minimize the number of columns required to support the embankment and increase the efficiency of the design, a load transfer platform (LTP) reinforced with geosynthetic reinforcement is being used on a regular basis. The load transfer platform consists of one or more layers of geosynthetic reinforcement placed between the top of the columns and the bottom of the embankment.

This paper will present the guidelines for the design of column supported embankments developed by the authors under contract with the Federal Highway Administration. These guidelines were developed based on a review of current design methodologies and a parametric study of design variables using numerical modeling (FLAC).

1.0 DESCRIPTION

Column supported embankments consist of vertical columns that are designed to transfer the

load of the embankment through the soft compressible soil layer to a firm foundation. The selection of the type of column used for the CSE will depend on the design loads, constructability of the column, cost, etc., and is not the focus of this paper (see Collin, 2004). The load from the embankment must be effectively transferred to the columns to prevent punching of the columns through the embankment fill causing differential settlement at the surface of the embankment. If the columns are placed close enough together, soil arching will occur and the load will be transferred to the columns. Figure 1 shows a conventional CSE. The columns are spaced relatively close together, and some battered columns are required at the sides of the embankment to prevent lateral spreading. In order to minimize the number of columns required to support the embankment and increase the efficiency of the design, a geosynthetically reinforced load transfer platform (LTP) may be used. The load transfer platform consists of one or more layers of geosynthetic reinforcement placed between the top of the columns and the bottom of the embankment. Figure 2 shows schematically a CSE with geosynthetic reinforcement.

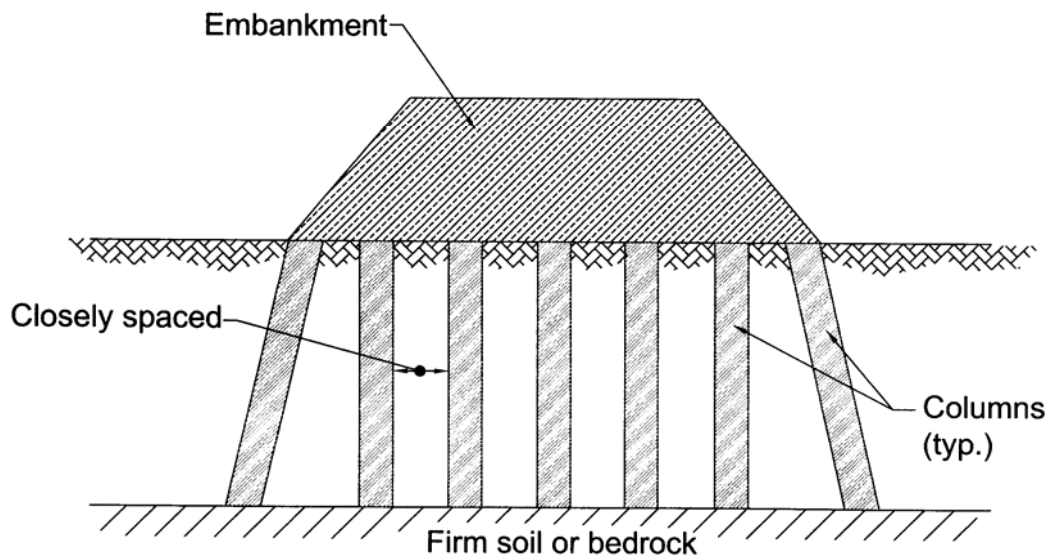


Figure 1. Conventional Column Supported Embankment

2.0 DESIGN CONCEPTS

The design of column supported embankments must consider both limit state, and serviceability state failure criteria. The limit state failure modes are shown in Figure 3. The columns must be designed to carry the vertical load from the embankment without failing (Figure 3a). The columns are typically assumed to carry the full load from the embankment. The lateral extent of the columns under the embankment must be determined (Figure 3b). The load transfer platform must be designed to transfer the vertical load from the embankment to the columns (Figure 3c). The potential for lateral sliding of the embankment on top of the columns must be addressed (Figure 3d). Finally, global stability of the system must be evaluated (Figure 3e).

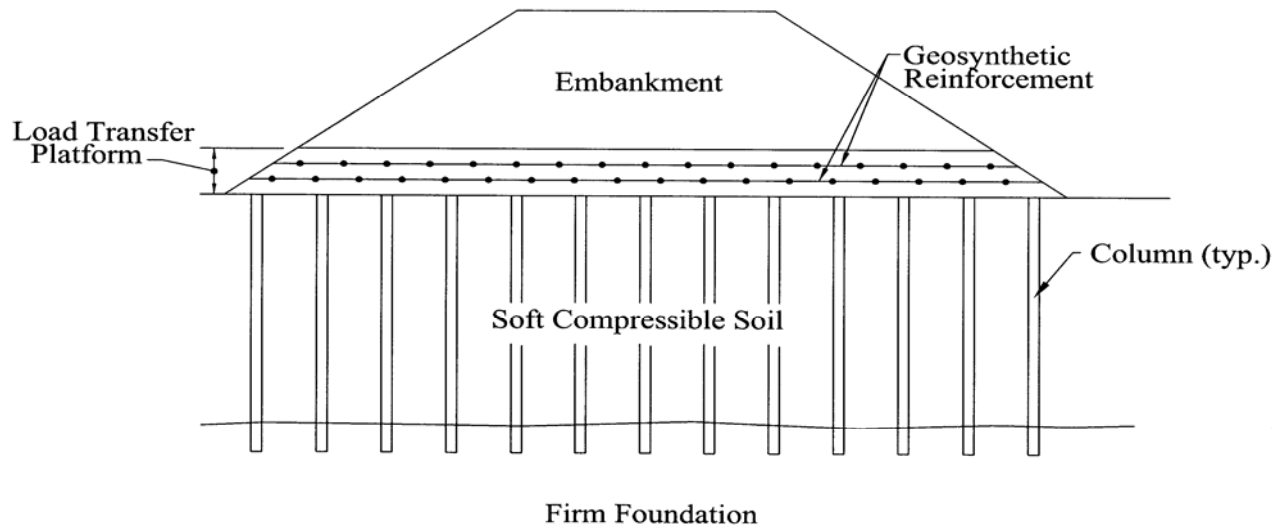


Figure 2. Column supported embankment with a geosynthetic reinforced load transfer platform

In addition to limit state analysis, serviceability state design must be considered. The strain in the geosynthetic reinforcement used to create the load transfer platform should be kept below some maximum threshold to preclude unacceptable deformation reflection (*i.e.*, differential settlement) at the top of the embankment. Settlement of the columns must also be analyzed to assure that unacceptable settlement of the overall system does not occur, as shown in Figure 4.

The general design steps for a CSE are provided below:

1. Estimate preliminary column spacing (use feasibility assessment guidelines).
2. Determine required column load.
3. Select preliminary column type based on required column load and site geotechnical requirements.
4. Determine capacity of column to satisfy limit and serviceability state design requirements.
5. Determine extent of columns required across the embankment width.
6. Select LTP design approach (*i.e.*, catenary or beam).
7. Determine reinforcement requirements based on estimated column spacing (step 1).
Revise column spacing as required.
8. Determine reinforcement requirements for lateral spreading.
9. Determine overall reinforcement requirements based on LTP and lateral spreading.
10. Check global stability.
11. Prepare construction drawings and specifications.

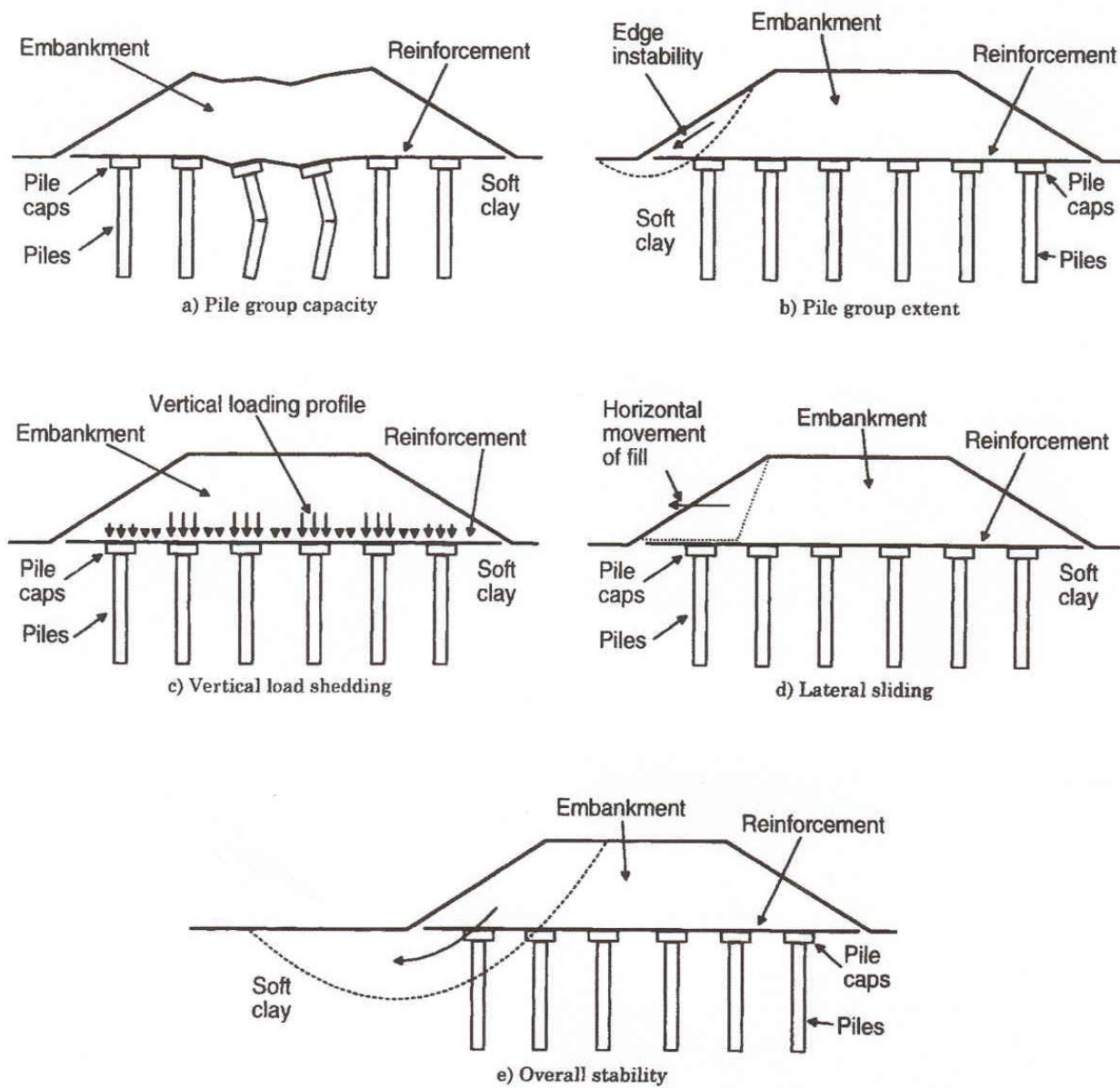


Figure 3. Limit State Failure Modes (BS8006)

The majority of the design steps follow conventional geotechnical engineering practice and is covered extensively in British Standard BS 8006 and the paper “*Column Supported Embankment Design Considerations*” (Collin, 2004) and will only be briefly covered within this paper. The much more controversial aspect of the design, the design of the load transfer platform (LTP) will be the focus of this paper.

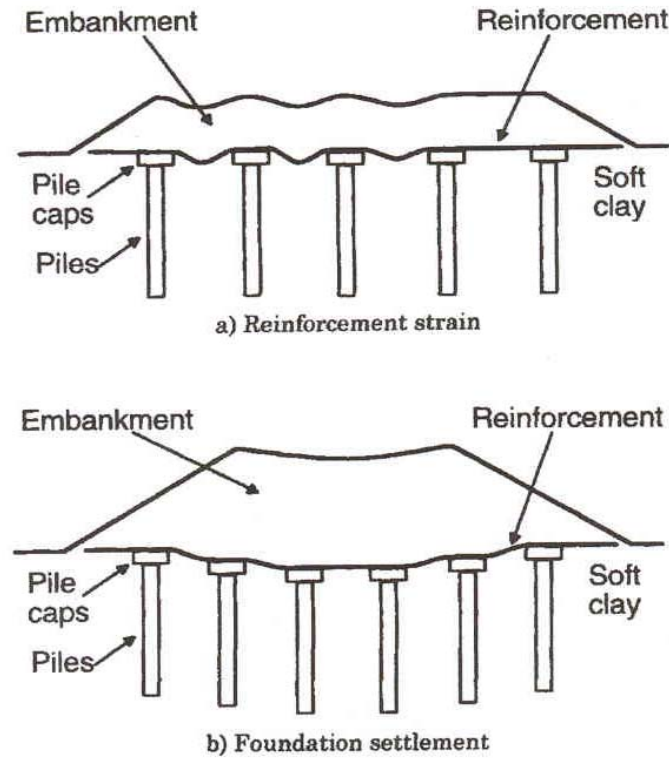


Figure 4. Serviceability State (BS8006)

3.0 COLUMN DESIGN

The selection of column type is most often based on constructability, load capacity, and cost. The load that a column is required to carry is typically based on the tributary area for each column. The embankment and any surcharge load is typically assumed to be carried in their entirety by the columns.

For purposes of determining the design vertical load in the column, it is convenient to associate the tributary area of soil surrounding each column, as illustrated in Figure 5. Although the tributary area forms a regular hexagon about the column, it can be closely approximated as an equivalent circle having the same total area. For square column pattern, the effective diameter (diameter D_e) is equal to 1.13 times the center-to-center column spacing. For triangular column pattern, the effective diameter is equal to 1.05 times the center-to-center column spacing (typical center-to-center column spacing ranges from 1.5- 3.0 m (5-10 ft.)).

The required design vertical load (Q_r) in the column is determined according to the following equation:

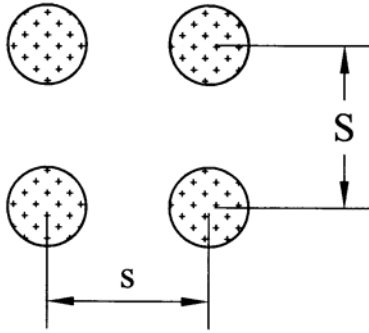
$$Q_r = \pi(D_e/2)^2 (\gamma H + q) \quad (1)$$

where: D_e = effective tributary area of column

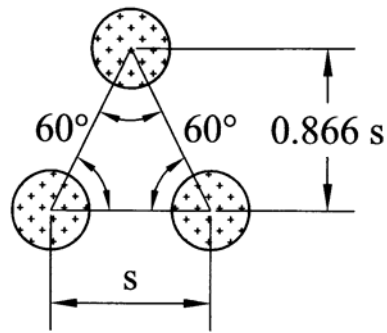
H = height of embankment

q = live and dead load surcharge (typically 12 kN/m^2 (250 psf))

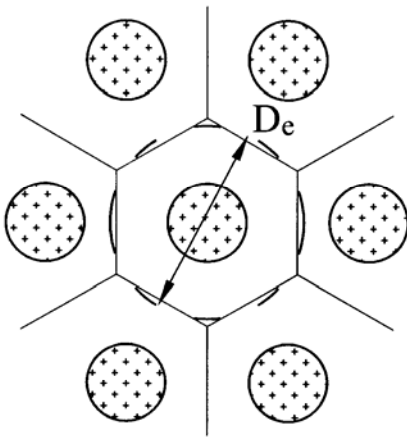
γ = unit weight of the embankment soil



a) Square Spacing



b) Triangular Spacing



c) Effective Diameter

$D_e = 1.05 s$ for Triangular Spacing

$D_e = 1.13 s$ for Square Spacing

Figure 5. Column Layout

4.0 EDGE STABILITY- LATERAL EXTENT OF COLUMNS

The lateral extent of the column system across the width of the embankment should extend a sufficient distance beyond the edge of the embankment to ensure that any instability or differential settlement that occurs outside the column supported area will not affect the embankment crest (Figure 3b). There are several approaches that may be used to check the edge stability. The computer software developed for FHWA for the design of both reinforced and non-reinforced slopes and embankments, ReSSA, is an excellent tool for checking edge stability.

The British Standard (BS8006) requires that the columns extend to within a minimum distance (L_p) of the toe of the embankment. Figure 6 defines the terms for edge stability. L_p is determined from the following equation:

$$L_p = H (n \cdot \tan \theta_p) \quad (2)$$

where:

- n = side slope of the embankment
- θ_p = is the angle (from vertical) between the outer edge of the outer-most column and the crest of the embankment [$\theta_p = (45 - \phi_{emb}/2)$].
- ϕ_{emb} = effective friction angle of embankment fill

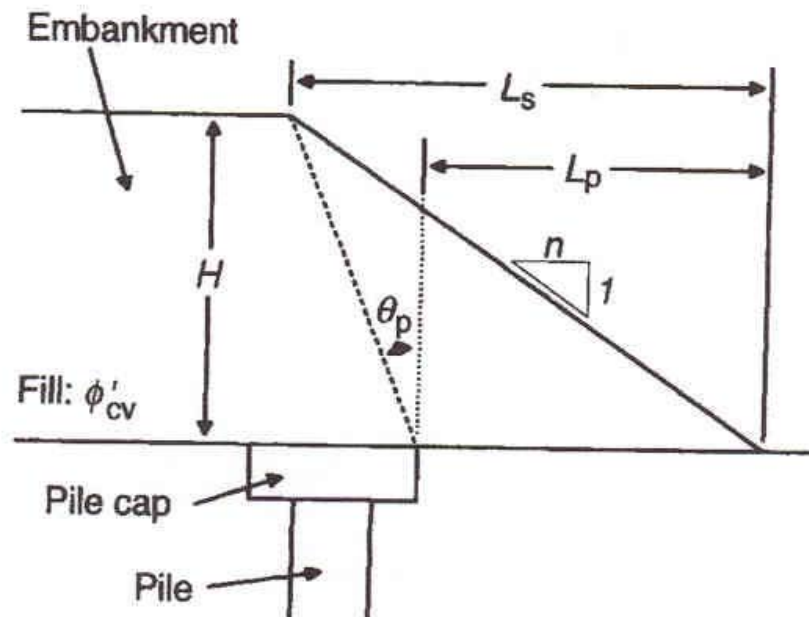


Figure 6. Edge Stability (BS 8006)

The British method is an excellent check of the more rigorous stability analysis using limit

The design of the load transfer platform (Collin Method, Collin, 2004) is based on the use of multiple layers of reinforcement to create a stiff reinforced soil mass (Figure 8). The Collin Method is a refinement of a method sometimes referred to as the Guido Method and assumes that the reinforced soil mass acts as a beam to transfer the load from the embankment above the platform to the columns below. The primary assumptions for the beam theory are:

- A minimum of three layers of reinforcement is used to create the platform.
- Spacing between layers of reinforcement is 200-450 mm (8-18 in.).
- Platform thickness is greater than or equal to one half the clear span between columns.
- Soil arch is fully developed within the depth of the platform.

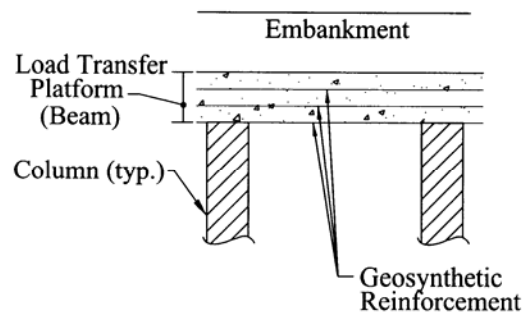


Figure 8. Load transfer mechanism – beam method

6.1 Tension Membrane

In addition to soil arching, the load transfer platform design includes tension membrane theory. The vertical load from the soil within the arch and any surcharge load, if the thickness of the embankment is not great enough to develop the full arch, is carried by the reinforcement. There are several theories available to estimate the tension in the reinforcement (Fluet and Giroud). Figure 9 shows the symbols that will be used in presenting the LTP design. They are defined below:

d	=	diameter of the column
H	=	height of embankment
P_c'	=	vertical stress on the column
q	=	surcharge load
s	=	center-to-center column spacing
T_{RP}	=	tension in the extensible reinforcement
W_T	=	vertical load carried by the reinforcement

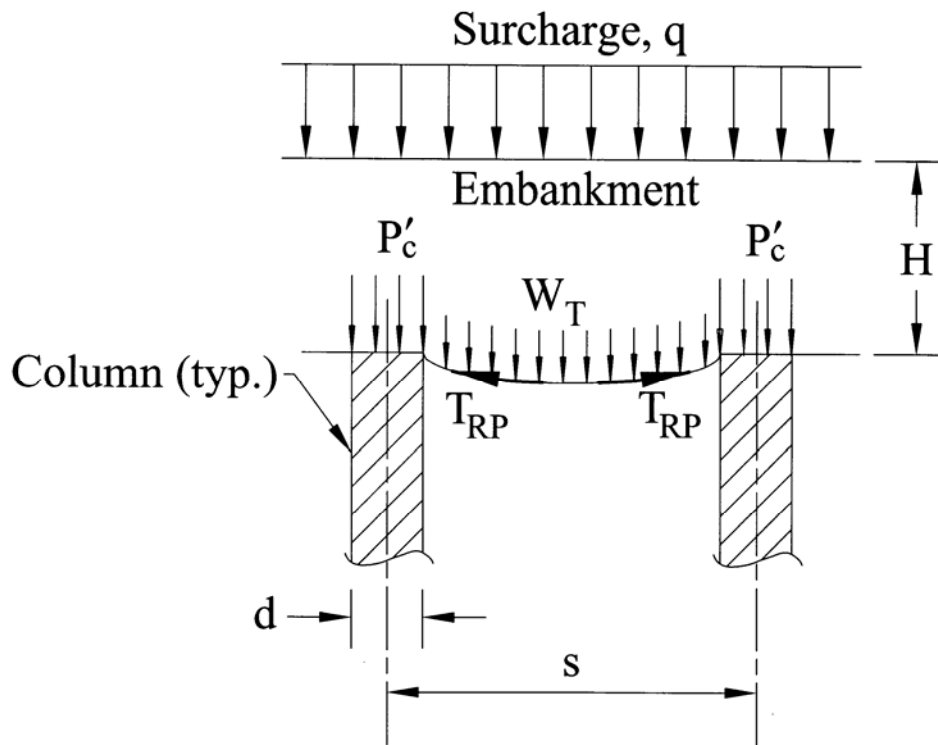


Figure 9. Definition of terms

6.2 Beam Method

The beam (Collin) method is based on the following assumptions:

- The thickness (h) of the load transfer platform is equal to or greater than one half the clear span between columns ($s-d$).
- A minimum of three layers of extensible (geosynthetic) reinforcement is used to create the load transfer platform.
- Minimum distance between layers of reinforcement is 150 mm (6 in.).
- Select fill is used in the load transfer platform.
- The primary function of the reinforcement is to provide lateral confinement of the select fill to facilitate soil arching within the height (thickness) of the load transfer platform.
- The secondary function of the reinforcement is to support the wedge of soil below the arch.
- The vertical load from the embankment above the load transfer platform is transferred to the columns below the platform.
- The initial strain in the reinforcement is limited to 5%.

The vertical load carried by each layer of reinforcement is a function of the column spacing pattern (*i.e.*, square or triangular) and the vertical spacing of the reinforcement. If the subgrade soil is strong enough to support the first lift of fill, the first layer of reinforcement is located 0.15-

0.25 m (6-10 in.) above subgrade. Each layer of reinforcement is designed to carry the load from the platform fill that is within the soil wedge below the arch. The fill load attributed to each layer of reinforcement is the material located between that layer of reinforcement and the next layer above (Figure 10).

The uniform vertical load on any layer (n) of reinforcement (W_{Tn}) may be determined from the equation below for an angle of arching of 45 degrees:

$W_{Tn} = (\text{area at reinforcement layer } n + \text{area at reinforcement layer } (n+1))/2$
 (layer thickness) (load transfer platform fill density)/(area at reinforcement layer n)

$$W_{Tn} = [A_n + A_{n+1}] h_n \gamma / 2 A_n \quad (5)$$

where: A = Area at reinforcement layer n or n+1
 = $[(s-d) - 2(\Sigma \text{Reinforcement Vertical Spacing}/\tan 45)]^2$ for square column spacing
 = $[(s-d) - 2(\Sigma \text{Reinforcement Vertical Spacing}/\tan 45)]^2 \sin 60/2$ for triangular column spacing

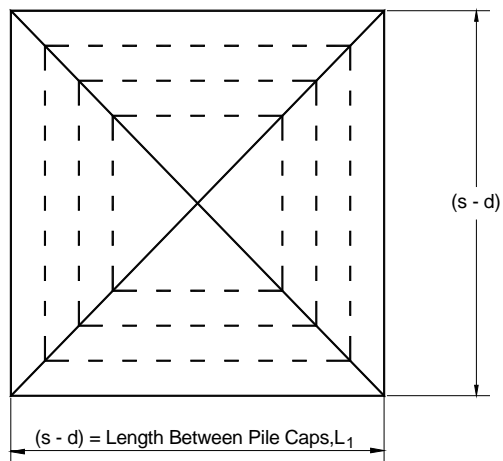
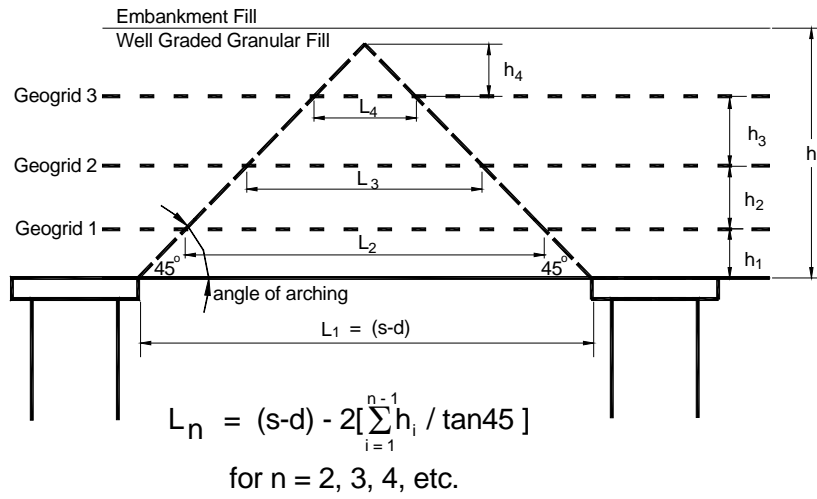
The tensile load in the reinforcement is determined based on tension membrane theory and is a function of the amount of strain in the reinforcement. The tension in the reinforcement is determined from the following equation:

$$T_{rpn} = W_{Tn} \Omega D/2 \quad (6)$$

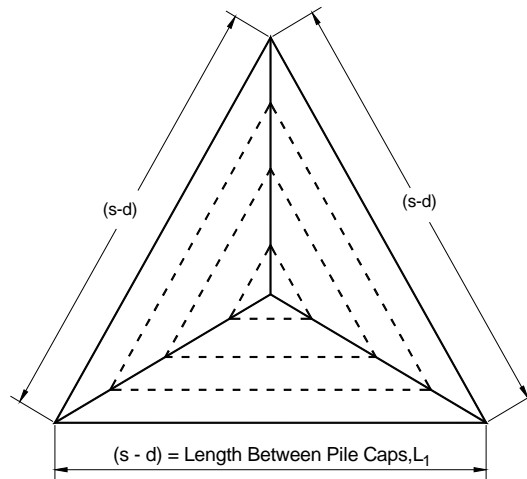
where: D = design span for tensioned membrane
 = $1.41 * [(s-d) - 2(\Sigma \text{Vertical Spacing}/\tan 45)]$ for square column spacing
 = $0.867 * [(s-d) - 2(\Sigma \text{Vertical Spacing}/\tan 45)]$ for triangular column spacing
 Ω = dimensionless factor from tensioned membrane theory

Table 1. Values of Ω .

Ω	Reinforcement Strain (ϵ)%
2.07	1
1.47	2
1.23	3
1.08	4
0.97	5



Square Column Spacing



Triangular Column Spacing

Figure 10. Load transfer platform design Collin method

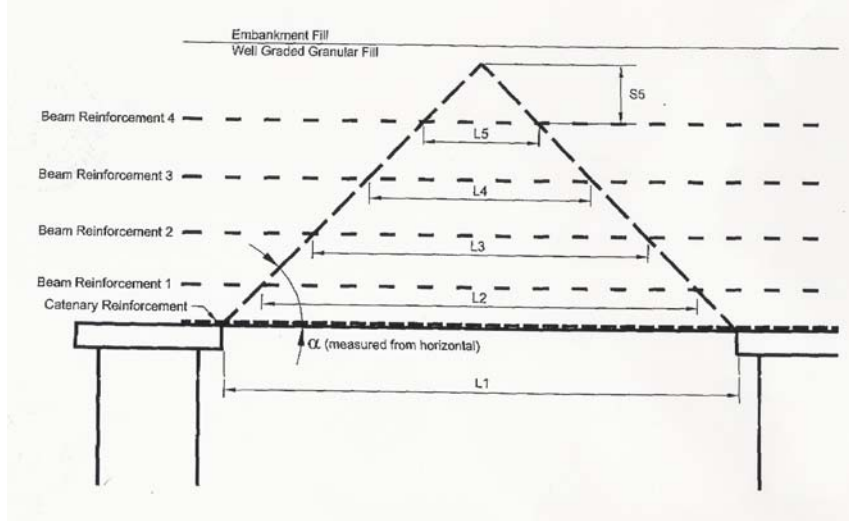


Figure 11. Modified beam method reinforcement

6.3 Modified Beam Method

Based on research recently completed (Collin, et. al., 2005) using numerical modeling the above procedure has been modified. The modification involves the addition of one layer of reinforcement at subgrade. This layer of reinforcement is designed as a catenary to carry the load from the soil below the arch (Figure 11).

The uniform vertical load on the catenary layer of reinforcement (W_{TC}) may be determined from the equation below:

$$W_{TCn} = (\text{volume pyramid below the arch}) (\text{load transfer platform fill density}) / (\text{area at reinforcement catenary layer})$$

$$W_{Tn} = h_n \gamma / 3 \quad \text{Square or Triangular column spacing} \quad (7)$$

The tensile load in the reinforcement is determined based on tension membrane theory and is a function of the amount of strain in the reinforcement. The tension in the reinforcement is determined from the following equation:

$$T_{rpC} = W_{TC} \Omega D / 2 \quad (8)$$

where: D = design span for tensioned membrane
 $= 1.41 * [(s-d) - 2(\Sigma \text{Vertical Spacing} / \tan 45^\circ)]$ for square column spacing
 $= 0.867 * [(s-d) - 2(\Sigma \text{Vertical Spacing} / \tan 45^\circ)]$ for triangular column spacing
 Ω = dimensionless factor from tensioned membrane theory

The reinforcement to create the beam above the catenary layer of reinforcement is designed according to equations 5 and 6.

7.0 CONCLUSIONS

The use of CSE is expanding both in the US and abroad. Numerous design guidelines have been developed for the design. Currently there are at least 5 to 10 methods to design the load transfer platform. The method presented here is one that has been developed by the authors and used with great success. However, the recommendations provided in this paper cover only the basic steps in the design of the LTP. The detailing of the platform (i.e., edge detail), selection of geosynthetic reinforcement, creep characteristics of the geosynthetic, overlaps, etc. are beyond the scope of this paper but must be considered in the design.

ACKNOWLEDGEMENTS

The authors would like to thank the Federal Highway Administration for financial support and Michael Adams for his guidance and insight in the performance of reinforced soil.

REFERENCES

Bell, A.L., Jenner, C., Maddison, J.D., and Vignoles, J. (1994), "Embankment support using geogrids with Vibro Concrete Columns." *Proceedings, 5th International Conference on Geotextiles, Geomembranes and Related Products*, 1, Singapore.

British Standard BS 8006 (1995), *Code of Practice for Strengthened/Reinforced Soils and Other Fills*. British Standard Institution, London.

Collin, J.G., Han, J., and Huang, J. (2005), "Design Recommendations for Column Supported Embankments," FHWA-HRT-XXX-XX, August.

Collin, J.G. (2004) "Column Supported Embankment Design Considerations", *Proceedings 52nd Annual Geotechnical Conference*, University of Minnesota, Minneapolis, MN. February 27, 2004.

Collin, J.G., Watson, C.H., and Han, J. (2005), "Column Supported Embankment Solves Time Constraint for New Road Construction", *ASCE Geo-Frontiers Conference*, Austin TX, January, 2005.

Elias, V., Lukas, R., Bruce, D., Collin, J.G., and Berg, R.R. (2004) *Ground Improvement Methods Reference Manual*, Federal Highway Administration FHWA NHI-04-001, July 2004.

Giroud, J.P., Bonaparte, R., Beech, J.F., and Gross, B.A. (1990), "Design of soil layer-geosynthetic systems overlying voids." *Geotextiles and Geomembrane*, Elsevier, 9(1).

Han, J.

Han, J., and Collin, J.G., (2005), “Geosynthetic Support Systems over Pile Foundations”, GRI 18 Conference: Geosynthetics in Transportation and Geotechnical Engineering, Austin, Texas, January, 2005.

Han, J., Collin, J.G., and Huang, J. (2004), “Recent Developments of Geosynthetic Reinforced Column Supported Embankments”, 55th Annual Highway Geology Symposium, Kansas City, MO, September, 2004.

Han, J. (2003), “Development of Design Charts for Geotechnically Reinforced Embankments on Deep Mixed Columns.” *National Deep Mixing Cooperative Research Program, Project No NDM 202*.

Han, J. (1999), “Design and construction of embankments on geosynthetic reinforced platforms supported by piles.” *Proceedings of 1999 ASCE/PaDOT Geotechnical Seminar*, Central Pennsylvania Section, ASCE and Pennsylvania Department of Transportation, Hershey, PA.

Huang, J., Collin, J.G., and Han, J. (2005), “Geogrid-Reinforced Pile-Supported Railway Embankments – Three Dimensional Numerical Analysis”, Transportation Research Board – 84th Annual Meeting, January 9-13, 2005, Washington, D.C.

Huang, J., Collin, J.G., and Han, J. (2005), “3D Numerical Modeling of a Geosynthetic-Reinforced Pile-Supported Embankment – Stress and Displacement Analysis”, 16th International Conference on Soil Mechanics and Geotechnical Engineering, September 12-16, 2005, Osaka, Japan (in press).

Jenner, C.G., Austin, R.A., and Buckland, D. (1998), “Embankment support over piles using geogrids.” *Proc. of 6th International Conference on Geosynthetics*, Vol. 1.

McNulty, J.W. (1965), “An Experimental study of arching in sand.” *Technical Report No. I-674*, U.S. Army Engineer Waterways Experiment Station, Corps of Engineers, Vicksburg, Mississippi.

Reid, W.M. and Buchanan, N.W. (1984), “Bridge approach support piling.” *Piling and Ground Treatment*, Thomas Telford Ltd, London.

Young, L.W., Milton, M.N., Collin, J.G., and Drooff, E. (2003), “Vibro-Concrete Columns and Geosynthetic Reinforced Load Transfer Platform Solve Difficult Foundation Problem.” *Proceedings for 22nd World Road Congress, South Africa*.